Public Works and Government Services Canada

Requisition No. EZ899-170474

SPECIFICATIONS
for
Glacier National Park – Rogers Pass Maintenance Compound –
Water Source Conversion
Rogers Pass, BC

Project No. R.076550.001
May 2016

APPROVED BY:

Regional Manager, AES — Date: 2016-06-24

Construction Safety Coordinator — Date: 2016-06-02

TENDER:

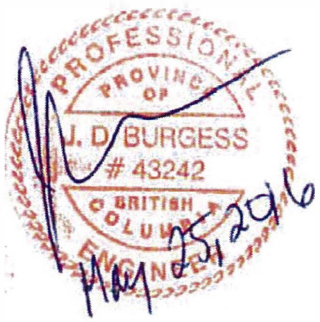
Project Manager — Date: 16/06/21

Real Property Services Branch, Professional and Technical Services, Pacific Region
#219 - 800 Burrard Street, Vancouver, B.C. V6Z 0B9

SPECIFICATIONS

P02	P&ID Standard Symbols, Equipment, Valves and Instrumentation
P03	Existing Water Treatment System
P04	New Water Treatment System
Electrical	
E01	Electrical - Site Plan & Single Line Diagram
E02	Electrical – Block Diagrams & Control Panel Layout
E03	Electrical – Building Plan
E04	Electrical – Schematic Diagram
E05	Electrical – Schematic Diagram

END OF INDEX

DISCIPLINE	SEAL
PRIME CONSULTANT CIVIL ENGINEER	
ARCHITECT	
PROCESS (DIVISION 11 SPECIFICATIONS)	

MECHANICAL (DIVISION 22 & 23 SPECIFICATIONS)	PROFESSIONAL ENGINEER PROVINCE OF BRITISH COLUMBIA M. T. McCARTNEY # 35787 2016/05/05
ELECTRICAL	PROFESSIONAL ENGINEER T. T. WATANABE # 16312 May 10, 2016

END OF SECTION

PART 1 - GENERAL

1.1 Location of Site

.1 The work is located at the Rogers Pass Maintenance Compound, approximately 70km east of Revelstoke, BC, along Highway 1 near the summit of Rogers Pass.

.2 The site of work is in Glacier National Park, located on federal land.

1.2 General Description of Work

.1 Work under this contract covers providing new groundwater supply to the Rogers Pass Water Treatment Plant and providing a new water treatment system within the plant, including associated works. The existing water treatment plant is currently fed from Connaught Creek, an environmentally sensitive water body that experiences fluctuations in water supply throughout the year. Converting the plant to groundwater will provide a more stable source with less environmental impacts.

.2 Work to be performed under this contract includes but is not limited to, the following items covered in the contract documents:

- .1 Supply, install and connect new well pumps complete with pitless adapters.
- .2 Supply, install and connect above-ground disconnect switches, junction boxes submersible pressure transmitters and accessories at each well.
- .3 Connect well supply to the treatment plant via previously installed water mains and electrical conduits.
- .4 Supply, install and connect new splitter, circuit breakers, VFDs, filters, junction boxes, branch circuit breakers and associated wiring.
- .5 Supply, install and connect new water treatment process within the plant to the new well water source, including:
  - .1 Ultraviolet (UV) treatment
  - .2 Sodium Hypochlorite dosing system with new pumps, prior to clearwell connection.

.6 Connect the treated water from the new treatment system to the existing clearwell.

.7 Supply and install new turbidity analyzer to measure turbidity of well water flowing to the treatment system.

.8 Supply and install new flow transmitter to measure flow from the new wells.

.9 Supply and install heat tracing and insulation on new incoming well water line.

.10 Construct an enclosed chlorine storage room.

.11 Supply, install and connect new lighting & exhaust fans and associated controls in chlorine storage room.

.12 Supply, fit and install an emergency shower/eyewash station and hot water tanks, with all associated plumbing for water supply, water collection, and drainage.

.13 Supply and install new well pumps control panel.

.14 Connect new well pumps, treatment system and associated instrumentation to new control panel and interconnect new control panel with existing control panel.

.15 Install and coordinate all equipment and mechanical controls.

.16 Undertake equipment and system performance testing, and operational testing, without interrupting water supply to the Rogers Pass Maintenance Compound. Treated water is to be available to the compound at all times.

.17 Assist the Departmental Representative with commissioning the new water treatment system.

1.3 Related Sections

.1 Section 01 35 33 – Health and Safety Requirements.

1.4 References

.1 Meet or exceed requirements of specified standards, codes and referenced documents.

1.5 Required Documents

.1 Maintain one copy at job site:

.1 Contract drawings, Safety Plan and Waste Reduction Workplan.
.2 Specifications.
.3 Addenda
.4 Change orders
.5 Other modifications to contract
.6 Copy of approved work schedule
.7 Health and Safety plan.
.8 Environmental Emergency Response Plan (including Spill Response Plan)

1.6 Drawings

.1 Contract Drawings:
.1 Provide four (4) full size sets of the drawings following contract award.
.2 Record Drawings:
.1 Provide two sets of drawings and specifications for as-built purposes. Maintain accurate records on one set. At Substantial Completion, transfer all notations to the other set and submit it to the Department Representative.
.2 Production of CAD Record Drawings are not included within the Contract.

1.7 Site Condition

.1 Information on the drawings regarding existing utilities was compiled from the Municipal record drawings, construction drawings and field surveys. This information is not necessarily complete or accurate. The Contractor is responsible for verifying all data by exposure prior to any construction and to immediately report any discrepancies to the Departmental Representative if remedial action is required. Any claims resulting from the Contractor's failure to do so shall be at the Contractor's expense.
.2 Make inquiries or investigations necessary to become thoroughly acquainted with site, soil, surface, stream and road access conditions, and the nature and extent of the work.

.3 Submission of a tender will be deemed confirmation that the Contractor is acquainted with the site and is conversant with all relevant conditions.

1.8 Ground Condition Data

.1 The Departmental Representative has no detailed ground condition data for this site.

1.9 Layout of Work

.1 Construction layout is the responsibility of Contractor.

.2 Notify Departmental Representative immediately if the work cannot be completed as shown in the plans and specifications.

1.10 Sequencing of Work

.1 Submit a plan clearly indicating proposed sequencing of Work to the Department Representative for approval.

.1 Include documents submittals warning Department Representative of forthcoming activities.

.2 Sequence work to ensure that full treated water service is maintained to the Rogers Pass Maintenance Compound throughout the duration of the project.

.1 Ensure treated water level in the clearwell is at maximum reserve prior to any service interruption of existing treatment system or supply of treated water supply to the clearwell.

.2 Any interruption to treated water supply into clearwell is to be no longer than 6 hours in duration with a maximum of 3 occurrences over the duration of the Work. The interruption is to be limited to between 9:00am and 3:00pm, Monday to Friday. Coordinate any such interruption with Departmental Representative.

.3 Wednesdays: Coordinate ongoing work with the Departmental Representative to ensure that scheduled plant water sampling tasks are not affected by the current construction.

.4 Whenever a variation from the schedule in excess of 5 working days occurs or is expected to occur, request approval from Departmental Representative for the change in writing.

1.11	Assistance by the Contractor	.1	Provide access to the work areas as required for the Departmental Representative to perform their duties.
1.12	Time of Completion	.1	Complete all work, including all required submittals, under the contract within ten (10) weeks of award.
1.13	Use of Site	.1	Use of site is limited to work areas required for the work, including the storage of materials and equipment and to the access routes assigned by the Departmental Representative required for the completion of work as specified.
		.2	Access keys will be provided to the contractor so that work can be completed outside the water treatment plants normal working hours.
			.1 Coordinate working hours with Departmental Representative.
1.15	Pre-Construction Meeting and Notifications	.1	Contact the Departmental Representative prior to construction to schedule a pre-construction meeting during which construction methods, timing and inspections will be discussed.
		.2	Notify the Departmental Representative a minimum of 48 hours prior to the required mobilization inspection.
		.3	Contact the Departmental Representative a minimum of 72 hours prior to the start of construction.
1.16	Project Meetings	.1	The Departmental Representative will arrange project meetings and assume responsibility for setting times and recording and distributing minutes.
1.17	Location of Equipment and Fixtures	.1	Location of existing equipment and fixtures indicated or specified is to be considered as approximate.
1.18	Existing Features	.1	Photograph, prior to construction, any existing features to be disturbed. Restore all disturbed features affected by the construction works to original conditions or better, and to the satisfaction of the Departmental Representative.

1.19 Inspection Services

.1 Inspections will be carried out by Departmental Representative.

.2 Where inspections reveal that work is not in accordance with the contract requirements, additional inspections to confirm acceptability of the corrected work will be conducted at the expense of the Contractor.

1.20 Interpretation

.1 In interpreting the Contract, in the event of discrepancies or conflicts between anything in the Plans and Specifications and the General Conditions, the General Conditions govern.

.2 In interpreting the Plans and Specifications, in the event of discrepancies or conflicts between:

.1 The Plans and Specifications, the Specifications govern;

.2 The Plans, the Plans drawn with the largest scale govern; and

.3 Figured dimensions and scaled dimensions, the figured dimensions govern.

1.21 Safe Companies Certification

.1 The Contractor must ensure that all works are performed by contractors who:

.1 Have current WCB registration and clearance;

.2 Have required WHIMIS training;

PART 2 - PRODUCTS

2.1 Not Applicable

PART 3 - EXECUTION

3.1 Not Applicable

END OF SECTION

PART 1 - GENERAL

1.1 Related Requirements

.1 Section 01 78 00 – Closeout Submittals

.2 Section 01 79 00 – Demonstration and Training

.3 Section 01 91 00 – General Commissioning Requirements

.4 Section 01 91 01 – Equipment and System Performance and Operational Testing

1.2 Administrative

.1 Submit to Departmental Representative submittals listed under each Section for review. Submit promptly and in orderly sequence to not cause delay in Work. Failure to submit in ample time is not considered sufficient reason for extension of Contract Time and no claim for extension by reason of such default will be allowed.

.2 Do not proceed with Work affected by submittal until review is complete.

.3 Present shop drawings, product data, samples and mock ups in SI Metric units.

.4 Review submittals prior to submission to Departmental Representative. This review represents that necessary requirements have been determined and verified, or will be, and that each submittal has been checked and co-ordinated with requirements of Work and Contract Documents. Submittals not stamped, signed, dated and identified as to specific project will be returned without being examined and considered rejected.

.5 Notify Departmental Representative, in writing at time of submission, identifying deviations from requirements of Contract Documents stating reasons for deviations.

.6 Verify field measurements and affected adjacent Work are co-ordinated.

.7 The review of the Environmental Emergency Response Plan by Departmental Representative is for sole purpose of ascertaining conformance with general concept.

.8 Contractor's responsibility for errors and omissions in submission is

not relieved by Departmental Representative's review of submittals.

.9 Contractor's responsibility for deviations in submission from requirements of Contract Documents is not relieved by Departmental Representative review.

.10 Keep one reviewed copy of each submission on site.

1.3 Submittals

.1 Allow 5 days for Departmental Representative's review of each submission.

.2 Adjustments made to submitted plans by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.3 Make changes to submitted plan as Departmental Representative may require, consistent with Contract Documents. When resubmitting, notify Departmental Representative in writing of revisions other than those requested.

.4 Accompany submissions with transmittal letter, in duplicate, containing:

.1 Date.

.2 Project title and number.

.3 Contractor's name and address.

.4 Identification and quantity of each shop drawing, product data and sample.

.5 Other pertinent data.

.5 Submissions are to include:

.1 Date and revision dates.

.2 Project title and number.

.3 Name and address of:

.1 Subcontractor.

.2 Supplier.

.3 Manufacturer.

.4 Contractor’s stamp, signed by Contractor’s authorized

representative, certifying approval of submissions, verification of field measurements and compliance with Contract documents.

.5 Details of appropriate portions of work as applicable:

.1 Fabrication.

.2 Layout, showing dimensions (including identified field dimensions) and clearances.

.3 Setting or erection details.

.4 Capacities.

.5 Performance characteristics.

.6 Standards.

.7 Operating weight.

.8 Wiring diagrams.

.9 Single line and schematic diagrams.

.10 Relationship to adjacent work.

.6 After Departmental Representative's review, distribute copies.

.6 Submit copies of product data sheets or brochures for requirements requested in specification Sections and as requested by Departmental Representative where shop drawings will not be prepared due to standardized manufacture of product.

.7 Submit copies of test reports for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Report signed by authorized official of testing laboratory that material, product or system identical to material, product or system to be provided has been tested in accord with specified requirements.

.2 Testing must have been within [3] years of date of contract award for project.

.8 Submit copies of certificates for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Statements printed on manufacturer's letterhead and signed

by responsible officials of manufacturer of product, system or material attesting that product, system or material meets specification requirements.

.2 Certificates must be dated after award of project contract complete with project name.

.9 Submit copies of manufacturer's instructions for requirements requested in specification Sections and as requested by Departmental Representative.

.1 Pre-printed material describing installation of product, system or material, including special notices and Material Safety Data Sheets concerning impedances, hazards and safety precautions.

.10 Submit copies of Manufacturer's Field Reports for requirements requested in specification Sections and as requested by Departmental Representative.

.11 Documentation of the testing and verification actions taken by manufacturer's representative to confirm compliance with manufacturer's standards or instructions.

.12 Submit copies of Operation and Maintenance Data for requirements requested in specification Sections and as requested by Departmental Representative.

.13 If upon review by Departmental Representative, no errors or omissions are discovered or if only minor corrections are made, Work may proceed. If submitted plan is rejected, noted copy will be returned and resubmission of corrected plan, through same procedure indicated above, must be performed before Work may proceed.

.14 All submissions to be made electronically in Adobe Acrobat ".PDF" format.

1.4 Shop Drawings

.1 Shop drawings: original drawings or modified standard drawings provided by Contractor to illustrate details of portions of work which are specific to project requirements and/or as requested by

the Department Representative.

.1 Format: Electronically in Adobe Acrobat ".PDF" format.

.2 Indicate materials, methods of construction and attachment or anchorage, erection diagrams, connections, explanatory notes and other information necessary for completion of Work. Where articles or equipment attach or connect to other articles or equipment, indicate that such items have been co-ordinated, regardless of Section under which adjacent items will be supplied and installed..

.3 Cross-reference shop drawing information to applicable portions of the Contract documents.

1.5 Shop Drawings Review

.1 Review of shop drawings by Department Representative is for the sole purpose of ascertaining conformance with the general concept.

.2 This review shall not mean that the Department Representative approves the detail design inherent in the shop drawings, responsibility for which shall remain with Contractor submitting same.

.3 This review shall not relieve the Contractor of responsibility for errors or omissions in the shop drawings or of responsibility for meeting all requirements of the construction and Contract documents.

.4 Without restricting the generality of the foregoing, the Contractor is responsible for:

.1 Dimensions to be confirmed and correlated at the job site.

.2 Information that pertains solely to the fabrication processes or to techniques of construction and installation.

.3 Coordination of the work of all the sub-trades.

1.6 Product Data

.1 Product data: manufacturers' catalogue sheets, MSDS sheets, brochures, literature, performance charts and diagrams, used to illustrate standard manufactured products or any other specified information.

.2 Delete information not applicable to project.

.3 Supplement standard information to provide details applicable to

project.

.4 Cross-reference product data information to applicable portions of Contract documents.

.5 Submit electronic PDF copies of product data.

1.7 Samples

.1 Samples: examples of materials, equipment, quality, finishes and workmanship.

.2 Submit for review samples as requested in respective specification Sections. Label samples with origin and intended use.

.3 Deliver samples prepaid to Departmental Representative.

.4 Notify Departmental Representative in writing, at time of submission of deviations in samples from requirements of Contract Documents.

.5 Where colour, pattern or texture is criterion, submit full range of samples.

.6 Adjustments made on samples by Departmental Representative are not intended to change Contract Price. If adjustments affect value of Work, state such in writing to Departmental Representative prior to proceeding with Work.

.7 Make changes in samples which Departmental Representative may require, consistent with Contract Documents.

.8 Reviewed and accepted samples will become standard of workmanship and material against which installed Work will be verified.

1.8 Certificates and Transcripts

.1 Immediately after award of Contract, submit Workers' Compensation Board status and clearance letter.

PART 2 - PRODUCTS

2.1 Not Applicable

PART 3 - EXECUTION

3.1 Not Applicable

END OF SECTION

1.1 References

.1 Government of Canada.
- .1 Canada Labour Code - Part II
- .2 Canada Occupational Health and Safety Regulations.

.2 National Building Code of Canada (NBC):
- .1 Part 8, Safety Measures at Construction and Demolition Sites.

.3 Canadian Standards Association (CSA) as amended:
- .1 CSA Z797-2009 Code of Practice for Access Scaffold
- .2 CSA S269.1-1975 (R2003) Falsework for Construction Purposes
- .3 CSA S350-M1980 (R2003) Code of Practice for Safety in Demolition of Structures

.4 Province of British Columbia:
- .1 Workers Compensation Act Part 3-Occupational Health and Safety.
- .2 Occupational Health and Safety Regulation

.5 National Fire Code of Canada 2010 (as amended):
- .1 Part 5 – Hazardous Processes and Operations and Division B as applicable and required

1.2 Related Sections

.1 Refer to the following sections as required:
- .1 General Instructions: Section 01 11 05
- .2 Package Sodium Hypochlorite System: Section 11 02 27
- .3 Earthworks for Minor Works: Section 31 00 99

1.3 Workers' Compensation Board Coverage

.1 Comply fully with the Workers' Compensation Act, regulations and orders made pursuant thereto, and any amendments up to the completion of the work.

.2 Maintain Workers' Compensation Board coverage during the term of the Contract, until and including the date that the Certificate of Final Completion is issued.

1.4 Compliance with Regulations

1 PWGSC may terminate the Contract without liability to PWGSC where the Contractor, in the opinion of PWGSC, refuses to comply with a requirement of the Workers' Compensation Act or the Occupational Health and Safety Regulations.

.2 It is the Contractor's responsibility to ensure that all workers are qualified, competent and certified to perform the work as required by the Workers' Compensation Act or the Occupational Health and Safety Regulations.

1.5 Submittals

.1 Submit to Departmental Representative submittals listed for review in accordance with Section 01 33 00 – Submittal Procedures.

.2 Work effected by submittal shall not proceed until review is complete.

.3 Submit the following:

.1 Health and Safety Plan.

.2 Copies of reports or directions issued by Federal and Provincial health and safety inspectors.

.3 Copies of incident and accident reports.

.4 Complete set of Material Safety Data Sheets (MSDS), and all other documentation required by Workplace Hazardous Materials Information System (WHMIS) requirements.

.5 Emergency Procedures.

.6 Copy of Worker's Compensation Board status and Clearance Letter.

.4 The Departmental Representative will review the Contractor's site-specific project Health and Safety Plan and emergency procedures, and provide comments to the Contractor within 5 days after receipt of the plan. Revise the plan as appropriate and resubmit to Departmental Representative.

.5 Medical surveillance: where prescribed by legislation, regulation or safety program, submit certification of medical surveillance for site personnel prior to commencement of work, and submit additional certifications for any new site personnel to Departmental

Representative.

.6 Submission of the Health and Safety Plan, and any revised version, to the Departmental Representatives for information and reference purposes only. It shall not:

.1 Be construed to imply approval by the Departmental Representative.

.2 Be interpreted as a warranty of being complete, accurate and legislatively compliant.

.3 Relieve the Contractor of his legal obligations for the provision of health and safety on the project.

1.6 Responsibility

.1 The Contractor is to assume the role of the "prime contractor" for the duration of the job.

.2 Prime Contractor shall assign a qualified Health and Safety Coordinator who shall:

.1 Be responsible for completing all health and safety training and ensuring that personnel that do not successfully complete the required training are not permitted to enter the site to perform work.

.2 Be responsible for implementing, revising, daily enforcing, and monitoring the Site Specific Health and Safety Plan.

.3 Be on site during execution of work.

.3 Be responsible for health and safety of persons on site, safety of property on site and for protection of persons adjacent to site and environment to extent that they may be affected by conduct of Work.

.4 Comply with and enforce compliance by employees with safety requirements of Contract documents, applicable Federal, Provincial, Territorial and local statutes, regulations, and ordinances, and with site-specific Health and Safety Plan.

1.7 General Conditions

.1 Provide safety barricades and lights around work site as required,

to provide a safe working environment for workers and protection for pedestrian and vehicular traffic.

.2 All excavation left open during non-construction and unsupervised periods is to be adequately fenced and barriered.

.3 Ensure that non-authorized persons are not allowed to circulate in designated construction areas of the work site.

.1 Provide appropriate means by use of barricades, fences, warning signs, traffic control personnel, and temporary lighting as required.

1.8 Regulatory Requirements

.1 Comply with specified codes, acts, bylaws, standards and regulations to ensure safe operations at site.

.2 In event of conflict between any provision of the above authorities, the most stringent provision will apply. Should a dispute arise in determining the most stringent requirement, the Departmental Representative will advise on the course of action to be followed .

1.9 Filing of Notice

.1 The Contractor is to complete and submit a Notice of Project as required by Provincial authorities.

.2 Provide copies of all notices to the Departmental Representative.

1.10 Health and Safety Plan

.1 Conduct a site-specific hazard assessment based on review of Contract documents, required work, and project site. Identify any known and potential health risks and safety hazards.

.2 Prepare and comply with a site-specific project Health and Safety Plan based on hazard assessment, including, but not limited to, the following:

.1 Primary requirements:

.1 Contractor's safety policy.

.2 Identification of applicable compliance obligations.

.3 Definition of responsibilities for project safety/organization chart for project.

.4 General safety rules for project.

.5 Job-specific safe work, procedures.

.6 Inspection policy and procedures.

.7 Incident reporting and investigation policy and procedures.

.8 Occupational Health and Safety Committee/ Representative procedures.

.9 Occupational Health and Safety meetings.

.10 Occupational Health and Safety communications and record keeping procedures.

.2 Summary of health risks and safety hazards resulting from analysis of hazard assessment, with respect to site tasks and operations which must be performed as part of the work.

.3 List hazardous materials to be brought on site as required by work.

.4 Indicate Engineering and administrative control measures to be implemented at the site for managing identified risks and hazards.

.5 Identify personal protective equipment (PPE) to be used by workers.

.6 Identify personnel and alternates responsible for site safety and health.

.7 Identify personnel training requirements and training plan, including site orientation for new workers.

.3 Develop the plan in collaboration with all subcontractors. Ensure that work/ activities of subcontractors are included in the hazard assessment and are reflected in the plan.

.4 Revise and update Health and Safety Plan as required, and re-submit to the Departmental Representative.

.5 Departmental Representative's review: the review of Health and Safety Plan by Public Works and Government Services Canada (PWGSC) shall not relieve the Contractor of responsibility for errors or omissions in final Health and Safety Plan or of responsibility for meeting all requirements of construction and Contract documents.

1.11 Emergency Procedures

.1 List standard operating procedures and measures to be taken in emergency situations. Include an evacuation plan and emergency contacts (i.e. names/telephone numbers) of:

.1 Designated personnel from own company.

.2 Regulatory agencies applicable to work and as per legislated regulations.

.3 Local emergency resources.

.4 Departmental Representative and site staff.

.2 Include the following provisions in the emergency procedures:

.1 Notify workers and the first-aid attendant, of the nature and location of the emergency.

.2 Evacuate all workers safely.

.3 Check and confirm the safe evacuation of all workers.

.4 Notify the fire department or other emergency responders.

.5 Notify adjacent workplaces or residences which may be affected if the risk extends beyond the workplace.

.6 Notify Departmental Representative.

.3 Provide written rescue/evacuation procedures as required for, but not limited to:

.1 Work at high angles.

.2 Work in confined spaces or where there is a risk of

entrapment.

.3 Work with hazardous substances.

.4 Underground work.

.5 Work on, over, under and adjacent to water.

.6 Workplaces where there are persons who require physical assistance to be moved.

.4 Design and mark emergency exit routes to provide quick and unimpeded exit.

.5 Revise and update emergency procedures as required, and re-submit to the Departmental Representative.

1.12 Hazardous Products

.1 Comply with requirements of Workplace Hazardous Materials Information System (WHMIS) regarding use, handling, storage and disposal of hazardous materials, and regarding labelling and provision of Material Safety Data Sheets (MSDS) acceptable to the Departmental Representative and in accordance with the Canada Labour Code.

.2 Where use of hazardous and toxic products cannot be avoided:

.1 Advise Departmental Representative beforehand of the product(s) intended for use. Submit applicable MSDS and WHMIS documents as per Section 01 33 00.

.2 In conjunction with Departmental Representative, schedule to carry out work during "off hours" when tenants have left the building.

.3 Provide adequate means of ventilation in accordance with Section 01 51 00.

1.13 Fire Safety Requirements

.1 Store oily/paint-soaked rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.2 Handle, store, use and dispose of flammable and combustible materials in accordance with the National Fire Code of Canada.

1.14 Unforeseen Hazards

.1 Should any unforeseen or peculiar safety-related factor, hazard or

condition become evident during performance of the work, immediately stop work and advise the Departmental Representative verbally and in writing.

1.15 Posted Documents

.1 Post legible versions of the following documents on site:

.1 Health and Safety Plan.

.2 Sequence of work.

.3 Emergency procedures.

.4 Site drawing showing project layout, locations of the first-aid station, evacuation route and marshalling station, and the emergency transportation provisions.

.5 Notice of Project.

.6 Floor plans or site plans.

.7 Notice as to where a copy of the Workers' Compensation Act and Regulations are available on the work site for review by employees and workers.

.8 Workplace Hazardous Materials Information System (WHMIS) documents.

.9 Material Safety Data Sheets (MSDS).

.10 List of names of Joint Health and Safety Committee members, or Health and Safety Representative, as applicable.

.2 Post all Material Safety Data Sheets (MSDS) on site, in a common area, visible to all workers and in locations accessible to tenants when work of this Contract includes construction activities adjacent to occupied areas.

.3 Postings should be protected from the weather, and visible from the street or the exterior of the principal construction site shelter provided for workers and equipment, or as approved by the Departmental Representative.

1.16 Meetings

.1 Attend health and safety pre-construction meeting and all subsequent meetings called by the Departmental Representative.

1.17 Correction of Non-Compliance

.1 Immediately address health and safety non-compliance issues

identified by the Departmental Representative.

.2 Provide Departmental Representative with written report of action taken to correct non-compliance with health and safety issues identified.

.3 The Departmental Representative may issue a "stop work order" if non-compliance of health and safety regulations is not corrected immediately or within posted time. The General Contractor/ subcontractors will be responsible for any costs arising from such a "stop work order".

END OF SECTION

PART 1 - GENERAL

1.1 Environmental Factors

.1 Ensure that operations meet all applicable environmental regulations and standards.

.2 Ensure no storm water runoff from the site of a deleterious nature is released into any storm sewers or water courses.

1.2 Disposal of Wastes

.1 Do not bury rubbish on site.

1.3 Fires

.1 Fires and burning on site is not permitted.

1.4 Work Adjacent to Waterways

.1 Do not operate construction equipment in waterways.

.2 Do not dump any waste material or debris in waterways.

1.5 Pollution Control

.1 Ensure all equipment is in proper working order.

.2 Control emissions from equipment to local authorities' emission requirements.

.3 Spill kits and containment materials must be maintained on-site and ready for deployment in case of spills.

.1 Spills kits are to contain sufficient quantities of absorbent material on site in close proximity to working machinery.

.2 During the work, there is to be trained and qualified personnel on site that ready to deploy spill kits when necessary.

1.6 Submittals

.1 Provide submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Submit an Environmental Emergency Response Plan, including spill response plan, to Department Representative for approval.

PART 2 - PRODUCTS

2.1 Not Applicable

PART 3 - EXECUTION

3.1 Work Procedures

.1 Prior to the start of the work, the Environmental Response Plan is to be submitted to the Departmental Representative as per Section 01 33 00.

.2 Work on site will be conducted in accordance with the plans and specifications, the Environmental Response Plan and all other applicable regulations.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 Inspection and testing, administrative and enforcement requirements.

.2 Equipment and system adjust and balance.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 79 00 – Demonstration and Training

.4 Section 01 91 00 – General Commissioning Requirements

.5 Section 03 30 00 – Cast In Place Concrete

.6 Section 33 11 16 – Site Water Utility Distribution Piping

1.3 Inspection

.1 Allow the Departmental Representative access to Work. If part of Work is in preparation at locations other than Place of Work, allow access to such Work whenever it is in progress.

.2 Give timely notice requesting inspection if Work is designated for special tests, inspections or approvals by the Departmental Representative instructions, or law of Place of Work.

.3 If Contractor covers or permits to be covered Work that has been designated for special tests, inspections or approvals before such is made, uncover such Work, have inspections or tests satisfactorily completed and make good such Work.

.4 Departmental Representative will order part of Work to be examined if Work is suspected to be not in accordance with Contract Documents. If, upon examination such work is found not in accordance with Contract Documents, correct such Work and pay cost of examination and correction.

1.4 Independent Inspection Agencies

.1 Engage Independent Inspection/ Testing Agencies, approved by the Departmental Representative, for purpose of inspecting and/ or testing portions of Work.

.2 Provide equipment required for executing inspection and testing by

appointed agencies.

.3 Employment of inspection/ testing agencies does not relax responsibility to perform Work in accordance with Contract Documents.

.4 If defects are revealed during inspection and/or testing, appointed agency will request additional inspection and/or testing to ascertain full degree of defect. Correct defect and irregularities as advised by the Departmental Representative at no cost to the Departmental Representative. Pay costs for retesting and re-inspection.

1.5 Access to Work

.1 Allow inspection/testing agencies access to Work, off site manufacturing and fabrication plants.

.2 Co-operate to provide reasonable facilities for such access.

1.6 Procedure

.1 Notify appropriate agency and the Departmental Representative in advance of requirement for tests, in order that attendance arrangements can be made. Minimum notice of 48 hours is required for the Departmental Representative.

.2 Submit samples and/or materials required for testing, as specifically requested in specifications. Submit with reasonable promptness and in orderly sequence to not cause delays in Work.

.3 Provide labour and facilities to obtain and handle samples and materials on site. Provide sufficient space to store and cure test samples.

1.7 Rejected Work

.1 Remove defective Work, whether result of poor workmanship, use of defective products or damage and whether incorporated in Work or not, which has been rejected by the Departmental Representative as failing to conform to Contract Documents. Replace or re-execute in accordance with Contract Documents.

.2 Make good other Contractor's work damaged by such removals or replacements promptly.

.3 If in opinion of the Departmental Representative it is not expedient to correct defective Work or Work not performed in accordance

with Contract Documents, Owner will deduct from Contract Price difference in value between Work performed and that called for by Contract Documents, amount of which will be determined by the Departmental Representative.

1.8 Reports

.1 Submit inspection and test reports to the Departmental Representative in accordance with Section 01 33 00 Submittal Procedures.

1.9 Tests and Mix Designs

.1 Furnish test results and mix designs as requested.

.2 Cost of tests and mix designs beyond those called for in Contract Documents or beyond those required by law of Place of Work will be appraised by Departmental Representative and may be authorized as recoverable.

1.10 Equipment and Systems

.1 Submit adjustment and balancing reports for mechanical, electrical and building equipment systems.

.2 Mechanical – coordinate with mechanical division.

.3 Electrical – coordinate with electrical division.

PART 2 - PRODUCTS

2.1 Not Applicable

PART 3 - EXECUTION

3.1 Not Applicable

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections	.1	Section 01 33 00 – Submittal Procedures.
	.2	Section 01 35 43 – Environmental Procedures.
1.2 Submittals	.1	Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.
1.3 Installation and Removal	.1	Provide temporary utilities controls and trailers necessary in order to execute work expeditiously, including for crew accommodation.
	.2	Remove from site all such work after use.
1.4 Dewatering	.1	Provide temporary drainage and pumping facilities to keep excavations and site free from standing water.
1.5 Water Supply	.1	Potable water for construction use will not be provided by PWGSC.
	.2	Arrange for connection with appropriate utility company and pay costs for installation, maintenance and removal.
1.6 Temporary Communication Facilities	.1	Provide and pay for any temporary telephone, fax, data hook up, lines, and equipment necessary for own use.
1.7 Fire Protection	.1	Provide and maintain temporary fire protection equipment during performance of Work required by governing codes, regulations and bylaws.
	.2	Burning rubbish and construction waste materials is not permitted on site.
1.8 Sanitary Facilities	.1	Provide, pay, and maintain for sanitary facilities for the duration of the work.

PART 2 - EXECUTION

2.1 Temporary Erosion and Sedimentation Control

.1 Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to requirements of authorities having jurisdiction.

.2 Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

.3 Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

END OF SECTION

PART 1 - GENERAL

1.1 Products/Material and Equipment

.1 All materials to be supplied by the Contractor.

.2 Use NEW products/material and equipment unless otherwise specified. The term "products" is referred to throughout the specifications.

.3 Use products of 1 manufacturer for material and equipment of the same type or classification unless otherwise specified.

.4 Unless otherwise specified, comply with manufacturer's latest printed instructions for materials and installation methods.

.5 Notify Departmental Representative in writing of any conflict between these specifications and manufacturer's instructions. Departmental Representative will designate which document is to be followed.

.6 Provide metal fastenings and accessories in the same texture, colour and finish as base metal in which they occur.

.1 Prevent electrolytic action between dissimilar metals.

.2 Use non-corrosive fasteners, anchors and spacers for securing exterior work.

.7 Fastenings which cause spalling or cracking are not acceptable.

.8 Use fastenings of standard commercial sizes and patterns with material and finish suitable for service.

.9 Use heavy hexagon heads, semi-finished unless otherwise specified.

.10 Bolts may not project more than 1 diameter beyond nuts.

.11 Types of washers as follows:

.1 Plain type washers: use on equipment and sheet metal.

.2 Soft gasket lock type washers: use where vibrations occur.

.3 Resilient washers: use with stainless steel.

.12 Deliver, store and maintain packaged material and equipment with manufacturer's seals and labels intact.

.13 Prevent damage, adulteration and soiling of products during delivery, handling and storage. Immediately remove rejected

products from site.

.14 Store products in accordance with suppliers' instructions.

.15 Touch up damaged factory finished surfaces to Departmental Representative's satisfaction.

.1 Use primer or enamel to match original.

.2 Do not paint over nameplates.

1.2 Quality of Products

.1 Products, materials and equipment (referred to as products) incorporated into work shall be new, not damaged or defective, and of the best quality (compatible with the specifications) for the purpose intended. If requested, furnish evidence as to type, source and quality of the products provided.

.2 Defective products will be rejected regardless of previous inspections.

.1 Inspection does not relieve responsibility, but is precaution against oversight or error.

.2 Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Retain purchase orders, invoices and other documents to prove that all products utilized in this Contract meet the requirements of the specifications. Produce documents when requested by the Departmental Representative.

.4 Should any dispute arise as to quality or fitness of products, the decision rests strictly with the Departmental Representative based upon the requirements of the Contract documents.

.5 Unless otherwise indicated in the specifications, maintain uniformity of manufacture for any particular or like item throughout the building.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

1.3 Availability of Products

.1 Immediately upon signing the Contract, review product delivery requirements and anticipate foreseeable supply delays for any items.

.2 If delays in supply of products are foreseeable, notify Departmental Representative of such in order that substitutions or other remedial action may be authorized in ample time to prevent delay in performance of the work.

.3 In event of failure to notify Departmental Representative at the start of work and should it subsequently appear that the work may be delayed for such reason, the Departmental Representative reserves the right to substitute more readily available products of similar character, at no increase in either the Contract price or the Contract time.

1.4 Manufacturer's Instructions

.1 Unless otherwise indicated in the specifications, install or erect products in accordance with the manufacturer's instructions.

.1 Do not rely on labels or enclosures provided with products

.2 Obtain written instructions directly from the manufacturer

.2 Notify Departmental Representative in writing of conflicts between the specifications and the manufacturer's instructions so that the Departmental Representative may establish the course of action.

.3 Improper installation or erection of products, due to failure in complying with these requirements, authorizes the Departmental Representative to require removal and re-installation at no increase in either the Contract price of the Contract time.

1.5 Contractor's Options For Selection of Products for Tendering

.1 Products are specified by "Prescriptive" specifications: select any product meeting or exceeding specifications.

.2 Products specified under "Acceptable Products" (used for complex Mechanical or Electrical Systems): select any one of the indicated manufacturers, or any other manufacturer meeting or exceeding the Prescriptive specifications and indicated Products.

.3 Products specified by performance and referenced standard: select

any product meeting or exceeding the referenced standard.

.4 Products specified to meet particular design requirements or to match existing materials: use only material specified Approved Product. Alternative products may be considered provided full technical data is received in writing by Departmental Representative in accordance with "Special Instructions to Tenderers".

.5 When products are specified by a referenced standard or by Performance specifications, upon request of Departmental Representative obtain from manufacturer and independent laboratory report showing that the product meets or exceeds the specified requirements.

1.6 Substitution After Contact Award

.1 No substitutions are permitted without prior written approval of the Departmental Representative.

.2 Proposals for substitution may only be submitted after Contract award. Such request must include statements of respective costs of items originally specified and the proposed substitution.

.3 Proposals will be considered by the Departmental Representative if:

.1 products selected by tenderer from those specified are not available;

.2 delivery date of products selected from those specified would unduly delay completion of Contract, or

.3 alternative product to that specified, which is brought to the attention of considered by Departmental Representative as equivalent to the product specified, and will result in a credit to the Contract amount.

.4 Should the proposed substitution be accepted either in part or in whole, assume full responsibility and costs when substitution affects other work on the project. Pay for design or drawing changes required as result of substitution.

.5 Amounts of all credits arising from approval of the substitutions will be determined by the Departmental Representative, and the Contract price will be reduced accordingly.

.6 The Departmental Representative's determination of products that are equal or better shall be final and binding.

PART 2 - PRODUCTS Not applicable

PART 3 - EXECUTION Not applicable

END OF SECTION

1.1	References	.1	Departmental Representative's identification of existing survey control points and property limits.
1.2	Qualifications of Surveyor	.1	Qualified registered land surveyor, licensed to practice in the Province of British Columbia, acceptable to Departmental Representative
1.3	Survey Reference Points	.1	Existing base horizontal and vertical control points are designated on drawings.
		.2	Locate, confirm and protect control points prior to starting site work. Preserve permanent reference points during construction.
		.3	Make no changes or relocations without prior written notice to Departmental Representative.
		.4	Report to Departmental Representative when reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.
		.5	Require surveyor to replace control points in accordance with original survey control
1.4	Survey Requirements	.1	Establish permanent bench marks on site, referenced to established bench marks by survey control points. Record locations, with horizontal and vertical data in Project Record Documents.
		.2	Establish lines and levels, locate and lay out, by instrumentation.
		.3	Stake for grading, fill placement.
		.4	Establish pipe invert elevations.
		.5	Establish lines and levels for all mechanical work.
1.6	Existing Services	.1	Before commencing work, establish location and extent of service lines in area of Work and notify Departmental Representative of findings.
		.2	Remove abandoned service lines within 2 m of structures. Cap or otherwise seal lines at cut-off points as directed by Departmental Representative.

1.7	Location of Equipment and Fixtures	.1	Location of equipment, fixtures, and outlets indicated or specified are to be considered as approximate.
		.2	Locate equipment, fixtures, and distribution systems to provide minimum interference and to maximize useable space in accordance with manufacturer's recommendations for safety, access, and maintenance.
		.3	Inform Departmental Representative of impending installation and obtain approval for actual location.
		.4	Submit field drawings to indicate relative position of various services and equipment when required by Departmental Representative.
1.8	Records	.1	Maintain a complete, accurate log of control and survey work as it progresses.
		.2	Record locations of maintained, re-routed and abandoned service lines.
1.9	Submittals	.1	Submit all required documentation in accordance with Section 01 33 00 – Submittal Procedures.
		.2	Submit name and address of Surveyor to Departmental Representative.
		.3	Submit certificate signed by surveyor certifying and noting those elevations and locations of completed Work that conform and do not conform with Contract Documents.

END OF SECTION

PART 1 - GENERAL

1.1 Waste Management Goals

.1 Prior to start of Work, submit for approval a written Waste Management plan to the Department Representative. Approval must be obtained prior to beginning onsite work.

.2 Accomplish maximum control of solid construction waste.

.3 Preserve environment and prevent pollution and environment damage.

1.2 Related Sections

.1 Section 01 51 00 – Temporary Utilities

.2 Section 03 30 00 – Cast in place Concrete

.3 Section 22 11 16.01 – Piping Systems

.4 Section 31 00 99 – Earthworks for Minor Works

.5 Section 33 11 16 – Site water Utility Distribution Piping

1.3 Definitions

.1 Inert Fill: inert waste – exclusively asphalt and concrete.

.2 Materials Source Separation Program (MSSP): consists of series of ongoing activities to separate reusable and recyclable waste material into material categories from other types of waste at point of generation.

.3 Recyclable: ability of product or material to be recovered at end of its life cycle and re-manufactured into new product for reuse.

.4 Recycle: process by which waste and recyclable materials are transformed or collected for purpose of being transferred into new products.

.5 Recycling: process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for purpose of using in altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

.6 Reuse: repeated use of product in same form but not necessarily for same purpose. Reuse includes:

.1 Salvaging reusable materials from re-modelling projects, before demolition stage, for resale, reuse on current project or for storage for use on future projects.

.2 Returning reusable items including pallets or unused products to vendors.

.7 Salvage: removal of structural and non-structural materials from deconstruction/disassembly projects for purpose of reuse or recycling.

.8 Separate Condition: refers to waste sorted into individual types.

.9 Source Separation: acts of keeping different types of waste materials separate beginning from first time they became waste.

.10 Waste Audit (WA): detailed inventory of materials in building. Involves quantifying by volume/weight amounts of materials and wastes generated during construction, demolition, deconstruction, or renovation project. Indicates quantities of reuse, recycling and landfill. Refer to Schedule A.

.11 Waste Reduction Workplan (WRW): written report which addresses opportunities for reduction, reuse, or recycling of materials. Refer to Schedule B. WRW is based on information acquired from WA (Schedule A).

1.4 Documents

.1 Maintain at job site, one copy of following documents:

.1 Waste Audit

.2 Waste Reduction Workplan

.3 Material Source Separation Plan.

.4 Schedules A & B completed for project

1.5 Submittals

.1 Submittals in accordance with Section 01 33 00 – Submittal Procedures.

.2 Prepare and submit following prior to project start up:

.1 Submit 2 copies of completed Waste Audit (WA): Schedule A.

.2 Submit 2 copies of completed Waste Reduction Workplan (WRW): Schedule B.

.3 Submit 2 copies of Materials Source Separation Program (MSSP) description.

1.6 Waste Audit (WA)

.1 Conduct WA prior to project start-up.

.2 Prepare WA: Schedule A.

.3 Record, on WA – Schedule A, extent to which materials or products used consist of recycled or reused materials or products.

1.7 Waste Reduction Workplan (WRW)

.1 Prepare WRW prior to project start-up.

.2 WRW should include but not limited to:

.1 Destination of materials listed.

.2 Deconstruction/disassembly techniques and sequencing.

.3 Schedule for deconstruction/disassembly.

.4 Location.

.5 Security.

.6 Protection.

.7 Clear labelling of storage areas.

.8 Details on materials handling and removal procedures.

.9 Quantities for materials to be salvaged for reuse or recycled and materials sent to landfill.

.3 Structure WRW to prioritize actions and follow 3R's hierarchy, with Reduction as first priority, followed by Reuse, then Recycle.

.4 Describe management of waste.

.5 Identify opportunities for reduction, reuse, and recycling of materials. Based on information acquired from WA.

.6 Post WRW or summary where workers at site are able to review content.

.7 Set realistic goals for waste reduction, recognize existing barriers and develop strategies to overcome these barriers.

.8 Monitor and report on waste reduction by documenting total volume and cost of actual waste removed from project.

1.8 Materials Source Separation Program (MSSP)

.1 Prepare MSSP and have ready for use prior to project start-up.

.2 Implement MSSP for waste generated on project in compliance with approved methods as reviewed by Departmental Representative.

.3 Provide on-site facilities for collection, handling, and storage of anticipated quantities of reusable and recyclable materials.

.4 Provide containers to deposit reusable and recyclable materials.

.5 Locate containers in locations, to facilitate deposit of materials without hindering daily operations.

.6 Locate separated material[s] in area[s] which minimize material damage.

.7 Collect, handle, store on-site, and transport off-site, salvaged materials in separate condition.

.1 Transport to approved and authorized recycling facility.

1.9 Storage, Handling And Protection

.1 Store, materials to be reused, recycled and salvaged in locations as directed by Departmental Representative.

.2 Unless specified otherwise, materials for removal become Contractor's property.

.3 Separate non-salvageable materials from salvaged items. Transport and deliver non-salvageable items to licensed disposal facility.

.4 Protect structural components not removed for demolition from movement or damage.

.5 Protect surface drainage, mechanical and electrical from damage and blockage.

.6 Prevent contamination of materials to be salvaged and recycled and handle materials in accordance with requirements for acceptance by designated facilities.

.1 On-site source separation is recommended.

.2 Provide waybills for separated materials.

1.10 Disposal Of Wastes

.1 Do not bury rubbish or waste materials.

.2 Do not dispose of waste into waterways, storm, or sanitary sewers.

.3 Keep records of construction waste including:

.1 Number and size of bins.

.2 Waste type of each bin.

.3 Total tonnage generated.

.4 Tonnage reused or recycled.

.5 Reused or recycled waste destination.

.4 Remove materials from deconstruction as deconstruction/ disassembly Work progresses.

.5 Prepare project summary to verify destination and quantities on a material-by-material basis as identified in pre-demolition material audit.

1.11 Use Of Site And Facilities

.1 Execute work with least possible interference or disturbance to normal use of premises.

.2 Maintain security measures established by existing facility.

1.12 Scheduling

.1 Co-ordinate Work with other activities at site to ensure timely and orderly progress of Work.

1.13 Application

.1 Do Work in compliance with WRW.

.2 Handle waste materials not reused, salvaged, or recycled in accordance with appropriate regulations and codes.

1.14 Cleaning

.1 Remove tools and waste materials on completion of Work, and leave work area in clean and orderly condition.

.2 Clean-up work area as work progresses.

.3 Source separate materials to be reused/ recycled into specified sort areas.

1.15 Diversion of Materials

.1 From following list, separate materials from general waste stream and stockpile in separate piles or containers, as reviewed by Departmental Representative, and consistent with applicable fire regulations.

.1 Mark containers or stockpile areas.

.2 Provide instruction on disposal practices.

.2 On-site sale of materials IS NOT permitted.

.3 Demolition Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Metals	100	
Rubble	100	
Wood (uncontaminated)	100	
Other		

.4 Construction Waste:

Material Type	Recommended Diversion %	Actual Diversion %
Cardboard	100	
Plastic Packaging	100	
Rubble	100	
Steel	100	
Wood (uncontaminated)	100	
Other		

1.16 Waste Audit .1 Schedule A – Waste Audit (WA):

Material Category	Material Quantity Unit	Estimated Waste %	Total Quantity of Waste (unit)	Generation Point	% Recycled	% Reused

1.17 Waste Reduction Workplan .1 Schedule B.

(1) Material Category	(2) Person(s) Responsible	(3) Total Quantity of Waste (unit)	(4) Reused Amount (units) Projected Actual	(5) Recycled Amount (unit) Project Actual	(6) Material Destination
Wood and Plastics Material Description					
Chutes					
Warped Pallet Forms					
Plastic Packaging					
Cardboard Packaging					
Wood					
Metal					
Other					

END OF SECTION

1.1 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 78 00 – Closeout Submittals.

.3 Section 01 91 00 – General Commissioning Requirements

1.2 Substantial Completion Inspection and Declaration Procedures

.1 Acceptance of Work Procedures:

.1 Notify the Departmental Representative in writing of satisfactory completion claim and request the Departmental Representative's inspection. A minimum of 7 days notice is required.

.2 Department Representative will complete an inspection and prepare a list of deficiencies and/or outstanding work.

.2 Completion Tasks: submit written certificates in English that deficiency tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Operation of systems: demonstrated to required personnel.

.4 Work: complete and ready for Final Inspection.

.3 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by the Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative.

.1 Complete outstanding items and request re-inspection.

.2 Incur all costs for re-inspection, including travel time for Department Representative.

.3 Declaration of Substantial Performance: when the Departmental Representative considers deficiencies and defects corrected and requirements of Contract substantially performed, make application for Certificate of Substantial Performance.

1.3 Final Cleaning

.1 Remove surplus materials, excess materials, rubbish, tools and equipment.

.2 Work site landscaping to be reinstated to pre-existing conditions or better.

.3 Waste Management: separate waste materials for reuse and recycling.

1.4 Total Performance Inspection and Declaration Procedures

.1 Acceptance of Work Procedures:

.1 Notify the Departmental Representative in writing of satisfactory completion claim and request the Departmental Representative's inspection.

.2 Department Representative will complete an inspection and prepare a list of deficiencies and/or outstanding work.

.2 Completion Tasks: submit written certificates in English that deficiency tasks have been performed as follows:

.1 Work: completed and inspected for compliance with Contract Documents.

.2 Defects: corrected and deficiencies completed.

.3 Final Inspection:

.1 When completion tasks are done, request final inspection of Work by the Departmental Representative, and Contractor.

.2 When Work incomplete according to Departmental Representative.

.1 Complete outstanding items and request re-inspection.

.2 Incur all costs for re-inspection, including travel time for Department Representative.

.3 Declaration of Total Performance: when the Departmental Representative considers deficiencies and defects corrected and requirements of Contract totally performed.

END OF SECTION

PART 1 - GENERAL

1.1 Related Requirements

.1 Section 03 30 00 – Cast In Place Concrete
.2 Section 11 02 26 – UV System
.3 Section 11 02 27 – Package Sodium Hypochlorite System
.4 Section 11 09 25 – Analytical Monitoring
.5 Section 22 10 10.01 – Submersible Well Pump
.6 Section 22 11 16.01 – Piping Systems
.7 Section 22 11 16.02 – Piping Joints
.8 Section 22 11 16.04 – Check Valves
.9 Section 22 11 16.05 – Isolating Valves
.10 Section 22 42 01.01 – Appurtenances
.11 Section 33 11 16 – Site Water Distribution Piping

1.2 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 Submittal Procedures.
.2 Two weeks prior to Substantial Performance of the Work, submit to the Departmental Representative, four final copies of operating and maintenance manuals in English.
.3 Provide spare parts, maintenance materials and special tools of same quality and manufacture as products provided in Work.
.4 Provide evidence, if requested, for type, source and quality of products supplied.

1.3 Format

.1 Organize data as instructional manual.
.2 Binders: vinyl, hard covered, 3 'D' ring, loose leaf 219 x 279 mm with spine and face pockets.
.3 When multiple binders are used correlate data into related consistent groupings.
.1 Identify contents of each binder on spine.
.4 Cover: identify each binder with type or printed title 'Project Record Documents'; list title of project and identify subject matter of contents.

.5 Arrange content by systems (i.e. utilities, controls) under Section numbers and sequence of Table of Contents.

.6 Provide tabbed fly leaf for each separate product and system, with typed description of product and major component parts of equipment.

.7 Text: manufacturer's printed data, or typewritten data.

.8 Drawings: provide with reinforced punched binder tab.

.1 Bind in with text; fold larger drawings to size of text pages.

.9 Provide Record Drawings and Final Survey data.

1.4 Contents – Project Record Documents

.1 Table of Contents for Each Volume: provide title of project;

.1 Date of submission; names.

.2 Addresses, and telephone numbers of Department Representative and Contractor with name of responsible parties.

.3 Schedule of products and systems, indexed to content of volume.

.2 For each product or system:

.1 List names, addresses and telephone numbers of subcontractors and suppliers, including local source of supplies and replacement parts.

.3 Product Data: mark each sheet to identify specific products and component parts, and data applicable to installation; delete inapplicable information.

.4 Drawings: supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams.

.5 Typewritten Text: as required to supplement product data.

.1 Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

1.5 As Built Documents And Samples

.1 Maintain, in addition to requirements in General Conditions, at site for the Departmental Representative one record copy of:

.1 Contract Drawings.
.2 Specifications.
.3 Addenda.
.4 Change Orders and other modifications to Contract.
.5 Reviewed shop drawings, product data, and samples.
.6 Field test records.
.7 Inspection certificates.
.8 Manufacturer's certificates.

.2 Store record documents and samples in field office apart from documents used for construction.
.1 Provide files, racks, and secure storage.

.3 Label record documents and file in accordance with Section number listings in List of Contents of this Project Manual.
.1 Label each document "PROJECT RECORD" in neat, large, printed letters.

.4 Maintain record documents in clean, dry and legible condition.
.1 Do not use record documents for construction purposes.

.5 Keep record documents and samples available for inspection by Departmental Representative.

1.6 Recording Information On Project Record Documents

.1 Record information on set of black line opaque drawings, provided by Departmental Representative.

.2 Use felt tip marking pens, maintaining separate colours for each major system, for recording information.

.3 Record information concurrently with construction progress.
.1 Do not conceal Work until required information is recorded.

.4 Contract Drawings and shop drawings: mark each item to record actual construction, including:
.1 Measured depths of elements of foundation in relation to geodetic datum.
.2 Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface

improvements.

.3 Field changes of dimension and detail.

.4 Changes made by change orders.

.5 Details not on original Contract Drawings.

.6 References to related shop drawings and modifications.

.5 Specifications: mark each item to record actual construction, including:

.1 Manufacturer, trade name, and catalogue number of each product actually installed, particularly optional items and substitute items.

.2 Changes made by Addenda and change orders.

.6 Other Documents: maintain manufacturer's certifications, inspection certifications, and field test records, required by individual specifications sections.

.7 Provide digital photos for site records.

1.7 Final Survey

.1 Submit final site survey certificate certifying that elevations and locations of completed Work are in conformance, or non conformance with Contract Documents.

1.8 Equipment And Systems

.1 For each item of equipment and each system include description of unit or system, and component parts.

.1 Give function, normal operation characteristics and limiting conditions.

.2 Include performance curves, with engineering data and tests, and complete nomenclature and commercial number of replaceable parts.

.2 Maintenance Requirements: include routine procedures and guide for trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

.3 Include manufacturer's printed operation and maintenance instructions.

.4 Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

.5 Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

. 6 Additional requirements: as specified in individual specification sections.

1.9 Maintenance Materials

.1 Spare Parts:

.1 Provide spare parts, in quantities specified in individual specification sections.

.2 Provide items of same manufacture and quality as items in Work.

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

.5 Obtain receipt for delivered products and submit prior to final payment.

.2 Special Tools:

.1 Provide special tools, in quantities specified in individual specification section.

.2 Provide items with tags identifying their associated function and equipment.

.3 Deliver to site; place and store.

.4 Receive and catalogue items.

.1 Submit inventory listing to Departmental Representative.

.2 Include approved listings in Maintenance Manual.

1.10 Delivery, Storage And Handling

.1 Store spare parts, maintenance materials, and special tools in manner to prevent damage or deterioration.

.2 Store in original and undamaged condition with manufacturer's seal and labels intact.

.3 Store components subject to damage from weather in weatherproof enclosures.

.4 Store paints and freezable materials in a heated and ventilated room.

.5 Remove and replace damaged products at own expense and for review by Departmental Representative.

1.11 Warranties and Bonds

.1 Develop warranty management plan to contain information relevant to Warranties.

.2 Submit warranty management plan, 15 days before planned Substantial Completion, to Departmental Representative.

.3 Warranty management plan to include required actions and documents to assure that the Departmental Representative receives warranties to which it is entitled.

.4 Provide plan in narrative form and contain sufficient detail to make it suitable for use by future maintenance and repair personnel.

.5 Assemble approved information in binder, submit upon acceptance of work and organize binder as follows:

.1 Separate each warranty or bond with index tab sheets keyed to Table of Contents listing.

.2 List subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

.3 Obtain warranties and bonds, executed in duplicate by subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

.4 Verify that documents are in proper form, contain full information, and are notarized.

.5 Co-execute submittals when required.

.6 Retain warranties and bonds until time specified for submittal.

.6 Conduct joint 12 month warranty inspection, measured from time of acceptance, by Departmental Representative.

.7 Include information contained in warranty management plan as follows:

.1 Roles and responsibilities of personnel associated with warranty process, including points of contact and telephone numbers within the organizations of Contractors, subcontractors, manufacturers or suppliers involved.

.2 Provide list for each warranted equipment, item, feature of construction or system indicating:

.1 Name of item.

.2 Model and serial numbers.

.3 Location where installed.

.4 Name and phone numbers of manufacturers or suppliers.

.5 Names, addresses and telephone numbers of sources of spare parts.

.6 Warranties and terms of warranty: include one-year overall warranty of construction. Indicate items that have extended warranties and show separate warranty expiration dates.

.7 Cross-reference to warranty certificates as applicable.

.8 Starting point and duration of warranty period.

.9 Summary of maintenance procedures required to continue warranty in force.

.10 Cross-Reference to specific pertinent Operation and Maintenance manuals.

.11 Organization, names and phone numbers of persons to call for warranty service.

.12 Typical response time and repair time expected for various warranted equipment.

.3 Contractor's plans for attendance at 12 month post-construction warranty inspections.

.4 Procedure and status of tagging of equipment covered by extended warranties.

.5 Post copies of instructions near selected pieces of equipment where operation is critical for warranty and/ or safety reasons.

.8 Respond in timely manner to oral or written notification of required

construction warranty repair work.

1.12 Warranty Tags

.1 Tag, at time of installation, each warranted item. Provide durable, oil and water resistant tag approved by Departmental Representative.

.2 Attach tags with copper wire and spray with waterproof silicone coating.

.3 Leave date of acceptance until project is accepted for occupancy.

.4 Indicate following information on tag:

.1 Type of product/material.

.2 Model number.

.3 Serial number.

.4 Contract number.

.5 Warranty period.

.6 Inspector's signature.

.7 Construction Contractor.

PART 2 - PRODUCTS

2.1 Not Used

.1 Not used.

PART 3 - EXECUTION

3.1 Not Used

.1 Not used.

END OF SECTION

PART 1 - GENERAL

1.1 Related Requirements

.1 Section 11 02 26 – UV System
.2 Section 11 02 27 – Package Sodium Hypochlorite System
.3 Section 11 09 25 – Analytical Monitoring
.4 Section 22 10 10.01 – Submersible Well Pump
.5 Section 22 11 16.01 – Piping Systems
.6 Section 22 11 16.02 – Piping Joints
.7 Section 22 11 16.04 – Check Valves
.8 Section 22 11 16.05 – Isolating Valves
.9 Section 22 42 01.01 – Appurtenances
.10 Section 23 34 00 – Fans
.11 Section 23 37 20.01 – Louvres
.12 Section 26 09 33 – Electronic and Electronic Control System for HVAC
.13 Section 26 27 26 – Wiring Devices
.14 Section 26 28 16.02 - Moulded Case Circuit Breakers
.15 Section 26 28 23 – Disconnect Switches - Fused and Non-Fused
.16 Section 26 29 03 – Control Devices
.17 Section 33 11 16 – Site Water Distribution Piping

1.2 Administrative Requirements

.1 Demonstrate operation and maintenance of equipment and systems to Departmental Representative prior to date of final inspection.
  .1 Utilize assistance from Manufacturer's Representatives for UV system, sodium hypochlorite dosing system and well pumps as a minimum.
.2 Departmental Representative to provide list of personnel to receive instructions, and co-ordinate their attendance at agreed upon times.

.3 Preparation:

.1 Verify conditions for demonstration and instructions comply with requirements.

.2 Verify designated personnel are present.

.3 Ensure equipment has been inspected and put into operation in accordance with Manufacturer's Recommendations, Contract Specifications, and to the satisfaction of the Department Representative.

.4 Ensure testing, adjusting, and balancing has been performed as required and that equipment and systems are fully operational.

.4 Demonstration and Instructions:

.1 Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, and maintenance of each item of equipment at agreed upon times, at the equipment location.

.2 Instruct personnel in phases of operation and maintenance using operation and maintenance manuals as basis of instruction.

.3 Review contents of manual in detail to explain aspects of operation and maintenance.

.4 Prepare and insert additional data in operations and maintenance manuals when needed during instructions.

1.3 Action and Informational Submittals

.1 Provide submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit schedule of time and date for demonstration of each item of equipment and each system two weeks prior to designated dates, for Departmental Representative's approval.

.3 Submit reports within one week after completion of demonstration, that demonstration and instructions have been satisfactorily completed.

.4 Give time and date of each demonstration, with list of persons present.

.5 Provide copies of completed operation and maintenance manuals for use in demonstrations and instructions.

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 This section describes the commissioning requirements for the projects systems and components.

1.2 Related Sections

.1 Section 01 79 00 – Demonstration and Training

.2 Section 11 02 26 – UV System

.3 Section 11 02 27 – Package Sodium Hypochlorite System

.4 Section 11 09 25 – Analytical Monitoring

.5 Section 22 10 10.01 – Submersible Well Pump

.6 Section 22 11 16.04 – Check Valves

.7 Section 22 11 16.05 – Isolating Valves

.8 Section 22 42 01.01 – Appurtenances

.9 Section 26– Electrical

1.3 General Requirements

.1 Commissioning activities under this section are not to be conducted until Equipment and System Performance and Operational Testing has been completed, as detailed in Section 01 91 01 – Equipment and System Performance and Operational Testing.

.2 Provide all necessary trades to assist with the commissioning of systems in accordance with this Section and as directed by the Departmental Representative's appointed Certified Commissioning Agent.

.3 The commissioning phase will be led by the Departmental Representative's appointed Certified Commissioning Agent, who will also provide final commissioning sign-off.

.4 Carry out additional tests as required to verify the proper operation of each piece of equipment and each system.

.5 Coordinate with the Departmental Representative's appointed Commissioning Agent throughout the commissioning of the equipment and systems specified under this contract.

.6 The Commissioning Agent shall add, modify, and refine the commissioning procedures, as approved by the Departmental Representative, to suit field conditions and actual manufacturer's

equipment, incorporate test data and procedure results, and provide detailed scheduling for all commissioning tasks.

.7 The Commissioning Agent will perform inspections to ensure completeness of systems. The agent will advise the contractor of equipment and system deficiencies using a work sheet that is updated regularly. Where immediate action is required on a deficiency or problem the agent will deliver a memo with the necessary information to the contractor.

.8 The items noted on the daily work sheet are specific to the commissioning process and are for the use of the mechanical and electrical contractors and sub-trades.

.9 The mechanical and electrical contractors shall advise the Commissioning Agent of any material supply problems or performance delays at the earliest opportunity.

.10 The Commissioning Agent will hold regular meetings prior to and during the commissioning period. The design authority and named contractors will appoint commissioning representatives. They will attend the meetings and take action on the recommendations as noted in the minutes.

.11 The activities of the Commissioning Team do not relieve the Contractor of their requirement to supply manpower as required to operate equipment and systems to permit safe completion of commissioning activities. Where possible they should attempt to coordinate their activities with the commissioning requirements to make the best use of time.

.12 Completion of the work described in this section will constitute start of the warranty period for that work which has been commissioned.

.13 Under no circumstances shall any part of the new works be brought online to the system for commissioning prior to successful completion of bacteriological testing described in Section 01 91 01 – Equipment and System Performance and Operational Testing.

1.4 Commissioning Team

.1 The Commissioning Team is to be developed as directed by the Departmental designated Commissioning Agent. At a minimum, the Commissioning Team is to be comprised of:

- .1 Certified Commissioning Agent.
- .2 General Contractor.
- .3 Departmental Representative.
- .4 Prime Consultant.
- .5 Division 11 Trades.
- .6 Division 22 Trades.
- .7 Division 23 Trades.
- .8 Division 26 Trades.
- .9 Manufacturer's Representatives for the well pumps, UV system and sodium hypochlorite pumping system.

1.5 Submittals

.1 Submit a schedule and checklist for the commissioning phase of work in accordance with Section 01 33 00 – Submittal Procedures. This schedule shall show:

- .1 Completions dates for each trade.
- .2 Timing of the various phases of the commissioning, testing, balancing, and demonstration process.
  - .1 Phase 1 – System Readiness.
  - .2 Phase 2 – System Start-Up, Testing, Balancing.
  - .3 Phase 3 – Verification of System Commissioning.
  - .4 Phase 4 – Demonstration and Training.
  - .5 Each Phase is applicable to each major and/or separate system making up the Work.
- .3 The name and contact information of the responsible person in each trade, and manufacturer's representatives.
- .4 Submission dates for the various documents required prior to substantial performance.

1.6 Personnel

.1 Assign a person to act as a direct point of contact with the Commissioning Agent (the Commissioning Representative).

.1 To be fully qualified through practical experience and have a comprehensive knowledge of the interactive nature of the installed systems and their controls.

1.7 Training

.1 Provide for training in accordance with Section 01 79 00 – Demonstration and Training.

1.8 Additional Laboratory Tests

.1 Should field tests indicate that equipment supplied to the project does not meet specifications, laboratory certification of the potentially deficient equipment may be requested by the Departmental Representative. In the event that equipment does not meet specification, the Contractor is responsible for the cost of:

.1 All required laboratory tests.

.2 All subsequent testing and correction required.

PART 2 - PRODUCTS

2.1 Not Used

.1 Not Used

PART 3 - EXECUTION

3.1 Phase 1 – System Readiness

.1 Before starting any of the separate systems, provide to the Commissioning Agent a certificate stating that the specific system is ready for start-up and the following conditions have been met.

.1 All safety controls installed and fully operational (dry run test).

.2 Qualified personnel are available to operate the equipment.

.3 Permanent electrical connections made to all equipment.

.2 System readiness shall include, but not necessarily be limited to, the following:

.1 Checking system physical completion, including all instrumentation.

.2 Flushing, chemical cleaning (as required), charging, fluid treating (as required).

.3 Equipment lubrication and pre-start checks.

.4 Filter systems installed and sealed in place.

.5 Adjusting vibration isolation and seismic restraints.

.6 Control function checks, including all alarms.

.7 Self-diagnostic packaged control items checked.

.3 All deficiencies to be recorded, reviewed by the Commissioning Team and, subsequently corrected before proceeding to the next phase, Phase 2.

3.2 Phase 2 – System Start-Up, Testing, Balancing.

.1 Phase 2 shall include, but not necessarily be limited to:

.1 Activation of all sub-systems.

.2 Testing and adjustment of all sub-systems.

.3 Major or composite system activation.

.4 Major or sub-system testing and adjustment.

.2 Pre-start checklists and check sheets for all mechanical equipment shall be signed off by the Mechanical Sub-Contractor and counter signed by the Commissioning Agent.

.3 Co-ordinate the start-up of the various pieces of equipment and systems. Utilize the start-up services of the manufacturer's representative. Ensure that the equipment is operating in a satisfactory manner.

.4 Troubleshooting

.1 Resolve inter-contractor co-ordination problems. Where problems become apparent during the commissioning process, work at the identification and resolution of these problems. The basic functions in trouble shooting are:

.1 What - Identification and definition of the problem.

.2 Why - Determination and evaluation of the causes.

.3 When - Determine the time available to resolve the problem.

.4 Involve the Commissioning Agent in the review of the problem and proposed resolution.

.5 Co-ordinate remedial action with the appropriate parties.

.6 Evaluate the effectiveness of the remedial action.

.5 Test the operation of the individual components and systems. Go through each step of the sequence of operation and verify that each component operates correctly.

.6 Ensure that all trades involved make the required changes and adjustments to affect the proper operation of all components and systems.

.7 All deficiencies to be recorded, reviewed by the Commissioning Team and, subsequently corrected before proceeding to the next phase, Phase 3.

3.3 Phase 3 – Verification of System Commissioning.

.1 Verification of commissioning by the Departmental Representative shall not commence until the commissioning process Phase 2, has been totally completed. Submit completion test certificates to the Departmental Representative at the time of requesting the commencement of the verification procedure. The verification process will include the demonstration of the following:

.1 Location of, and opening and closing of all access panels.

.2 Operation of all automatic and manual control systems.

.3 Operation of all equipment and systems, under each mode of operation.

.4 Noise level under extreme operating conditions.

3.4 Phase 4 – Demonstration and Training

.1 Demonstrate system operation and provide training in accordance with Section 01 79 00 – Demonstration and Training.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections

.1 Section 01 79 00 – Demonstration and Training

.2 Section 11 02 26 – UV System

.3 Section 11 02 27 – Package Sodium Hypochlorite System

.4 Section 11 09 25 – Analytical Monitoring

.5 Section 22 10 10.01 – Submersible Well Pump

.6 Section 22 11 16.04 – Check Valves

.7 Section 22 11 16.05 – Isolating Valves

.8 Section 22 42 01.01 – Appurtenances

.9 Section 23 34 00 – Fans

.10 Section 23 37 20.01 – Louvres

.11 Section 26 09 33 – Electronic and Electronic Control System for HVAC

.12 Section 26 27 26 – Wiring Devices

.13 Section 26 28 23 –Disconnect Switches - Fused and Non-Fused

.14 Section 26 29 03 –Control Devices

1.2 Description

.1 This Section contains general requirements for pre-commissioning testing (system performance and operational testing) by the Contractor of all new equipment and systems including mechanical, process, electrical, instrumentation, and HVAC.

.1 The Contractor is to include the use of Manufacturer's Representatives for on-site performance and operational testing of the UV system, sodium hypochlorite dosing and well pumps.

.2 This Section includes the following two (2) stages of testing:

.1 Performance Testing to test individual equipment and systems in order to demonstrate individual equipment and system compliance with performance requirements.

.2 Operational Testing to provide the operation and coordination of all aspects of the system including mechanical, electrical and instrumentation. Additionally, operational

testing is to verify and tune control loops. For the Contract, potable water from the existing water treatment system is to remain available for site consumption during Operational Testing.

.3 Operational testing shall not commence until performance testing is completed.

.4 Work specified in this Section shall precede Commissioning specified in Section 01 91 00 – General Commissioning Requirements.

.5 The programming, testing and commissioning of software for the RTU, HMI and SCADA computer will be performed by the Departmental Representative. The Contractor shall provide assistance to the Departmental Representative as needed.

.6 Performance testing of the individual equipment and systems shall be completed by the Contractor and the results submitted for review to the Departmental Representative prior to Operational testing as outlined in this Section.

.7 Operational testing of equipment and systems shall be completed by the Contractor and the results submitted for review to the Departmental Representative prior to Commissioning in accordance with Section 01 91 00 – General Commissioning Requirements.

.8 All testing in this Section is the responsibility of the Contractor, including assurance and coordination of sample collection and obtaining laboratory test results.

.9 The Contractor shall coordinate the activities of subcontractors and suppliers to implement the requirements of this section.

.10 This Section supplements but does not supersede specific testing requirements found elsewhere in the Specifications.

1.3 Quality Assurance

.1 Appoint a qualified operations specialist as Testing Coordinator to coordinate and supervise the Contractor's quality assurance program and test plan.

.2 Provide and follow a calibration program for both temporary and permanently installed instruments, gauges, meters, and monitors used for determining the performance of equipment and systems.

.1 Calibrate to within plus or minus 2 percent (where possible) of actual value at full scale all test equipment used for calibrating or verifying the performance of equipment installed under this contract.

.2 Calibrate pressure gauges in accordance with ANSI/ASME B40.1.

1.4 Submittals for Review

.1 Provide electronic pdf copies of the Performance Test Plan and Operational Test Plan in accordance with Section 01 33 00 – Submittal Procedures. Each plan shall include of the following:

.1 Detailed testing plans (Performance Test Plan and Operational Test Plan), setting forth step-by-step descriptions of the procedures proposed for the calibration and testing of all equipment, instrumentation, controller logic and systems installed under this Contract.

.2 A schedule, updated weekly, establishing the expected time period when the Contractor plans to commence field performance testing and operational testing of the completed systems.

.3 Sample forms for documenting the results of field performance tests and operational tests, including a tagging system to catalogue and sign-off on each test during each stage or type of test.

.4 Documentation showing performance test results of equipment and system prior to commencement of operational testing.

.5 Documentation showing operational test results of logic, equipment and systems prior to commissioning.

PART 2 - PRODUCTS

2.1 General

.1 Prepare test plans and documentation plans as described in these specifications.

.2 Do not begin test work for the equipment, system or facility until the reviewed final test plans have been delivered to the Departmental Representative.

.3 A "system" is defined as equipment, devices and appurtenances connected so that their operation complements, protects or controls the operation or function of the others.

2.2 Documentation

.1 Develop and implement a records keeping system to document compliance with the requirements of this Section. Include calibration documentation (by make, manufacturer, model, and serial number) of all test equipment, date of original calibration, subsequent calibrations, calibration method, and test laboratory.

.2 Provide test forms for date of test, equipment tag number or system name, nature of test (performance or operational), test objectives, test results, test instruments employed for the test and signature spaces for the Departmental Representative and Contractor. Maintain files for pipe pressure testing, mechanical equipment performance testing, instrumentation equipment performance testing (loops), and electrical equipment performance testing.

.3 The Contractor is advised that test forms provided as part of these documents are samples only. Develop and produce acceptable test forms for review by the Departmental Representative with the Performance Test Plan and Operational Test Plan. Once the Departmental Representative has reviewed and taken no exception to the test forms proposed by the Contractor, produce sufficient test forms to provide documentation of all testing work to be conducted as a part of this Contract.

.4 Develop test plans detailing the coordinated, sequential testing of each item of equipment and system installed under this Contract. As a minimum, include test plans with following features:

.1 Performance testing of each individual item of mechanical, HVAC, electrical and instrumentation equipment associated with a system. Select performance tests to duplicate the specified operating conditions.

.2 Operational testing of mechanical, HVAC, electrical and instrumentation systems to duplicate, as closely as possible, the specified range of operating conditions.

.3 Schedule and details on how the specified testing work will be implemented.

.4 The Contractor's test plan shall also include management, control and disposal of the super-chlorinated water and the discharge of any wastewater used in testing.

PART 3 - EXECUTION

3.1 General

.1 Demonstrate, to the Departmental Representative's complete satisfaction, that the structures, systems, and equipment meet specified performance test requirements and the facility is ready for the operational test period to commence. Once operational test requirements are fulfilled to the Departmental Representative's complete satisfaction, the facility is ready for the commissioning process to commence.

.2 The permanent power supply may be used at no cost to the Contractor, otherwise provide, at no expense to the Owner, all power, fuel, compressed air supplies, potable water, and chemicals, all labour, temporary piping, heating, ventilating, air conditioning and all other items and work required to complete the installed tests. Maintain temporary facilities until permanent systems are in service.

.3 Methods for disposal of test water to be approved by the Departmental Representative.

.4 Results of bacteriological test requirements completed in performance testing, shall be submitted to the Departmental Representative and the local health authority for acceptance prior to bringing any new works on-line. Obtain approval and coordinate with

the Owner, prior to any connection, disconnection, or testing any of the works on-line.

.5 The Contractor shall fully collaborate with Departmental staff and observe required protocols before commencing testing. Lockout procedures shall be established and employed. Contractor shall provide an emergency response plan, and a 24 hour contact in case of emergency.

3.2 Calibration of Permanent Instruments

.1 Calibrate analysis instruments, sensors, gauges, and meters on a system-by-system basis. Do not perform equipment or system performance acceptance tests until all loop continuity tests, instruments, gauges, and meters have been calibrated and results reviewed by the Departmental Representative.

3.3 Performance Tests

.1 Test each item of mechanical, process, HVAC, electrical, instrumentation equipment and system installed under this Contract to demonstrate compliance with the specified performance requirements.

.2 Disinfect and test new watermains and mechanical piping for leakage in accordance with 33 11 16 - Site Water Utility Distribution Piping.

.3 Any items disturbed or disconnected after testing will be subject to re-testing at no cost.

.4 When testing requires the availability of auxiliary systems which have not yet been placed in service, provide acceptable substitute sources, capable of meeting the requirements of the machine, device, or system at no additional cost to the Owner.

.5 Perform Pre-Operational Checkout:

.1 Prior to energization of electrical systems and equipment, ring out and test all circuits for continuity and shielding.

.2 Pre-operational checkout for mechanical and HVAC systems to include the following:

.1 Alignment of equipment.

.2 Pre-operation lubrication.

.3 Manufacturers' recommendations for pre-start preparation.

.6 Perform Component Calibration and Loop Testing:

.1 Prior to energization of instrumentation systems and equipment, calibrate and test all loops and associated instruments.

.7 RTU I/O testing

.1 Test each RTU input and output point (discrete and analog) and confirm that the field devices are sending and receiving signals correctly.

.8 Perform Electrical Resistance Testing

.1 Test the insulation resistance of electrical equipment and cable.

.9 Perform Functional Tests

.1 Once specified pre-operational check-out procedures are complete, equipment and systems may be started and operated under simulated operating conditions.

.2 Operate equipment a sufficient period of time to determine machine operating characteristics, including noise, temperatures and vibration; to observe and document performance characteristics; and to permit initial adjustment of operating controls.

.10 Test results to be within the tolerances set forth in the detailed Specifications. If no tolerances have been specified, test results to conform to tolerances established by recognized industry practice or referenced standards

.11 If under test, any portion of the Work should fail to fulfill the Contract requirements and therefore is adjusted, altered or replaced, repeat tests on that portion together with all other portions of the Work as are affected at no additional cost, within reasonable time and in accordance with the specified conditions.

.12 Once performance testing has been completed, recheck all equipment for proper alignment and realign, as required. Check all

equipment for loose connections, unusual movement, or other indications of improper operating characteristics. Correct any deficiencies to the satisfaction of the Departmental Representative.

3.4 Operational Tests

.1 Complete performance testing and ensure operational condition for all associated support utilities (PW potable water, NPW non-potable water, instrument loop checks, electrical systems, lube oil systems and any other system which may be required) before commencing operational testing.

.2 Include both local and RTU control in operational testing unless otherwise directed by the Departmental Representative. Operation of RTU logic, control and display, as set forth in the Specifications and Functional Description, shall be tested to the satisfaction of the Departmental Representative.

.3 Once equipment and or systems have been tested individually, fill each system with the intended fluids.

.4 Operate each system for a continuous period of not less than 3 days, simulating actual operating conditions to the greatest extent possible. During the operational testing period, monitor the characteristics of each piece of equipment according to manufacturer information and Specifications and report any unusual conditions to the Departmental Representative.

.5 Should the operational testing period be halted for any reason related to the facilities constructed or the equipment furnished under this Contract, repeat the operational testing program until the specified continuous period has been accomplished without interruption. The operational test period can be changed as directed by the Owner in writing.

.6 If under test, any portion of the Work should fail to fulfil the Contract requirements and therefore is adjusted, altered or replaced, repeat tests on that portion together with all other portions of the Work as are affected at no additional cost, within reasonable time and in accordance with the specified conditions.

.7 Following successful completion of the operational test period the system can be commissioned as specified in Section 01 91 00 – General Commissioning Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Related Sections	.1	Section 31 00 99 – Earthworks for Minor Works
1.2 Price and Payment Procedures	.1	Cast-in-place concrete will be measured incidental to other items that it forms a component of per the requirements of the Contract Drawings.
1.3 References	.1	CAN/ CSA-A23.1 Concrete Materials and Methods of Concrete Construction (Including Notes and Appendices in the Standard)
	.2	CAN/ CSA-A23.2 Test methods and standard practices for Concrete
	.3	CAN/ CSA-S269.3 Concrete Formwork
	.4	CAN/ CSA A3000 Supplementary Cementing Materials, Building Materials and Products
	.5	ACI 305R Hot weather concreting
	.6	ACI 306R Cold weather concreting
	.7	ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete
	.8	ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
	.9	ASTM C494 Standard Specification for Chemical Admixtures for Concrete
	.10	Additional material and testing standards listed in CAN/ CSA-A23.1.
1.4 Submittals	.1	Submit concrete mix designs of any mix designed by the Contractor to the Departmental Representative for review 14 days prior to placement. Concrete mix design submittals shall include the mass in kilograms of fine aggregate, coarse aggregate, cement, fly ash, silica fume and water in each cubic metre of concrete. Concrete mix design submittals shall specify the properties of the concrete.
	.2	Submit copies of all test results to the Departmental Representative

for review. Submission of test results will not relieve the Contractor from his obligation to interpret the test results and make necessary corrections or adjustments to his construction procedures or mix designs.

.3 At least four weeks prior to commencing work of this section, inform the Departmental Representative of proposed source of aggregates and provide access for sampling.

.4 Submit a letter of assurance that the proposed aggregate source will not produce concrete that will be compromised by deleterious effects from alkali-aggregate reaction.

1.5 Quality Control Submittals

.1 Provide proof of certification that plant, equipment, and materials including aggregates to be used in concrete comply with requirements of CAN/ CSA-A23.1.

.2 Submit test results based on trial mixes showing that concrete mix designs will produce concrete meeting the requirements of this section and that strength will comply with CAN/ CSA-A23.1.

.3 Submit manufacturer's datasheets and printed instructions for joint sealant and primer proposed for use in the Work.

1.6 Quality Assurance

.1 Quality Assurance: in accordance with Section 01 45 00 Quality Control.

.2 Perform all concrete Work in accordance with the requirements of CAN/ CSA A23.1.

.3 Concrete testing shall be performed by the Contractor, and results submitted to the Departmental Representative.

PART 2 - PRODUCTS

2.1 Concrete Materials

.1 Portland Cement and Supplementary Cementing Material : Type GU Portland cement to CAN/ CSA-A3000

.2 Water: to CAN/ CSA-A23.1.

.3 Aggregates: to CAN/ CSA-A23.1, normal density.

.4 Air Entraining Admixtures: to ASTM C260.

.5 Chemical Admixtures: to ASTM C494. Departmental Representative

to approve type and use of accelerating or set-retarding admixtures during cold and hot weather placing.

.6 Curing Compound: to CSA A23.1 and ASTM C309

2.2 Formwork Materials

.1 Formwork materials shall meet the requirements of CAN/ CSA-S269.3 and this section.

.2 Contact surfaces or lining of formwork shall be suitably smooth to provide finished concrete surfaces meeting the requirements of this section.

.3 Form Ties: threaded internal disconnecting type, leaving no holes larger than 1 in. diameter in concrete surface.

.4 Form Release Agent: non-staining chemically active release agent, compatible with form material which will prevent adherence of concrete to forms.

2.3 Concrete Mixes

.1 Select concrete mix proportions in accordance with CAN/ CSA-A23.1 to give the following properties for all cast-in-place concrete unless specified otherwise on design Drawings:

.1 Minimum Compressive Strength at 28 Days: 35 MPa.

.2 Maximum Water/Cementing Materials Ratio: 0.40.

.3 Exposure Class: C-1.

.4 Nominal Maximum Size of Coarse Aggregate: 20 mm.

.5 Slump at Time and Point of Discharge: 130 mm ± 25 mm.

.6 Air Content: 5% to 8%.

.2 Do not change concrete mix without prior approval of the Departmental Representative. Should change in material source be proposed, new mix design to be approved by the Departmental Representative.

2.4 Concrete Production

.1 Measure, batch and mix concrete in accordance with CAN/ CSA-A23.1.

.2 Before unloading concrete at the Site, furnish the Departmental Representative with a delivery ticket for each batch of concrete in accordance with CAN/ CSA-A23.1.

PART 3 - EXECUTION

3.1 General

.1 Prior to placing concrete, ensure that all reinforcing and other items to be embedded in concrete are in place, properly oriented, located, and secured. Verify that concrete may be placed to the lines and elevations shown on the Drawings with all required clearances and cover for reinforcement. Ensure that forms are clean and absolutely all debris has been removed.

.2 Obtain the Departmental Representative's approval before placing concrete. Provide 48 hours notice prior to placing of concrete.

.3 Prior to placing concrete, obtain the Departmental Representative's approval of proposed method for protection of concrete during placing and curing in adverse weather.

.4 Maintain accurate records of poured concrete items to indicate date, location of pour, quantity, air temperature and any Contractor's test samples taken.

3.2 Formwork

.1 Construct and erect formwork in accordance with CAN/ CSA-S269.3.

.2 Assemble forms to produce finished concrete conforming to shape, dimensions, locations and levels indicated within tolerances required by CAN/ CSA-A23.1.

.3 Align form joints and make watertight. Use minimum number of form joints.

.4 Clean formwork in accordance with CAN/ CSA-A23.1 before placing concrete.

3.3 Preparation

.1 Set sleeves, anchor bolts and other inserts as indicated or specified elsewhere. Sleeves and openings greater than 100 mm and not indicated on structural Drawings must be approved by the Departmental Representative.

.2 Do not eliminate or displace reinforcement to accommodate hardware. If inserts cannot be located as specified, obtain approval of all modifications from the Departmental Representative before placing of concrete.

3.4 Placing of Concrete – General

.1 Handle, deposit and consolidate concrete in accordance with CAN/ CSA-A23.1 and ACI A309R. Take care not to disturb forms or reinforcing steel when depositing and consolidating concrete.

.2 Ensure that spare internal vibrators or external form vibrators are on hand during placing of concrete.

.3 Unless specified otherwise, where fresh concrete will be placed against hardened concrete, bond the fresh concrete to the hardened concrete in accordance with CAN/ CSA-A23.1.

3.5 Construction Joints

.1 Make construction joints in accordance with CAN/ CSA-A23.1.

.2 Locate construction joints as indicated on the Drawings or as approved by the Departmental Representative. Construction joints not indicated on the Drawings will not be permitted without the prior authorization of the Departmental Representative.

3.6 Finishing Unformed Surfaces

.1 Top surfaces of concrete which will ultimately receive additional concrete:

.1 Screed the surface across the grade strips or forms so that the resulting surface will have no irregularities greater than the maximum size aggregate.

.2 Roughen the surface with 6 mm amplitude.

.3 Prior to placing additional concrete, clean the surface of: laitance, dirt, excess water, and other deleterious material. Do not use hydro-milling until sufficient time has elapsed to prevent loosening of the top aggregate.

.2 Top Surface of Exposed Concrete:

.1 Initial Finishing: immediately after placing concrete, screed the surface to the indicated grade and Work the surface with a bull float, or with a darby and highway straight edge, in accordance with CAN/ CSA-A23.1. Complete initial finishing before any bleeding or free water is present on the concrete surface.

.2 Begin final finishing operations after the bleed water has disappeared and the concrete has stiffened sufficiently to prevent the working of excess mortar to the surface. Do not add water to facilitate finishing. Carry out final finishing

operations in accordance with CAN/ CSA-A23.1.

.3 Unless noted otherwise, exterior surfaces shall receive a light broom finish, with broom striations approximately 2 mm deep.

.3 Finished surfaces shall conform to the slopes specified on the Drawings.

3.7 Finishing Formed Surfaces

.1 Finish formed surfaces in accordance with CAN/CSA-A23.1 and as specified below.

.2 Formed surfaces which may ultimately serve as forms for additional concrete pour or which will remain unexposed:

.1 The surface may contain shear keys, reinforcing steel, anchor bolts, or other embedments as indicated on the Drawings.

.2 Repair honeycomb concrete and fill form-tie holes. Remove fins and ridges from concrete surfaces.

.3 Clean the surface of laitance, dirt, excess water, and other deleterious material prior to applying waterproofing treatment or placing additional concrete.

3.8 Curing And Protection

.1 Cure and protect concrete in accordance with CAN/ CSA-A23.1 and as specified below.

.2 Cure topping concrete by the application of wetted burlap immediately after completion of finishing operations. Maintain burlap in a saturated condition using soaker hoses wrapped in burlap and installed on top of the deck surface. When the daily mean ambient temperature is above 5 deg. C, curing shall be continuous for a minimum of seven days or for the time necessary to attain 70% of the specified 28 day compressive strength.

.3 When the air temperature is at or above 27 deg. C, or when there is a probability of it rising to 27 deg. C during the placing period (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 305R - Hot Weather Concreting.

.4 When the air temperature is at or below 5 deg. C, or when there is a probability of it falling below 5 deg. C within 24 hours of placing (as forecast by the nearest official meteorological office), conform also to the requirements of ACI 306R - Cold Weather Concreting.

3.9 Tolerances

.1 Tolerances for concrete Work as built shall conform to CAN/ CSA-A23.1 unless indicated otherwise.

.2 Finish tolerances for concrete topping shall meet the requirements for the conventional (non-slip) Class B surface of CAN/ CSA-A23.1 Table 16.

.3 The flatness of the topping surface will be determined by the straightedge method as outlined in CAN/ CSA-A23.1.

3.10 Field Quality Control

.1 Inspection and testing of concrete and concrete materials shall be carried out by a Testing Laboratory approved by Departmental Representative, engaged and paid for by the Contractor, in accordance with CAN/ CSA A23.1.A "test" shall consist of a slump test, an air entrainment test, and samples collected for compression testing.

.2 Pumped concrete shall be sampled both at the truck discharge and at the point of final placement to determine if any changes in the slump, air content or other significant mix characteristics occur. The concrete at the forms shall meet all the requirements of this section.

.3 Additional test cylinders shall be taken during cold weather concreting. Cure cylinders on job Site under same conditions as concrete which they represent.

.4 Inspection or testing by Departmental Representative will not augment or replace Contractor quality control nor relieve him of his contractual responsibility.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM A53/A53M-12, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated Welded and Seamless.

.2 ASTM A269/A269M-14e1, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

.3 ASTM A307-14, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181, Ready Mixed Organic Zinc-Rich Coating.

.3 Canadian Standards Association (CSA)

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CAN/CSA G164-M92(R2003), Hot Dip Galvanizing of Irregularly Shaped Articles.

.3 CSA S16-14, Design of Steel Structures.

.4 CSA W48-14, Filler Metals and Allied Materials for Metal Arc Welding (Developed in co-operation with the Canadian Welding Bureau).

.5 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 The Master Painters Institute (MPI)

.1 Architectural Painting Specification Manual - current edition.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

1.3 Performance Requirements

.1 Design metal fabrications to withstand service loads and service environment.

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for sections, plates, pipe, tubing,

bolts. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.

.2 Indicate materials, core thicknesses, finishes, connections, joints, method of anchorage, number of anchors, supports, reinforcement, details, and accessories.

.3 Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.

.4 Certifications: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

PART 2 PRODUCTS

2.1 Materials

.1 Steel sections and plates: To CSA G40.20/G40.21, Grade 300W.

.2 Steel pipe: To ASTM A53/A53M standard weight, galvanized finish.

.3 Welding materials: To CSA W59.

.4 Welding electrodes: To CSA W48 Series.

.5 Bolts and anchor bolts: To ASTM A307.

.6 Stainless steel tubing: To ASTM A269, Type 302 seamless welded with No. 4 finish.

.7 Grout: Non-shrink, non-metallic, flowable, 15 MPa at 24 hours.

2.2 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

2.3 Fabrication

.1 Fabricate work square, true, straight and accurate to required size, with joints closely fitted and properly secured.

.2 Use self-tapping shake-proof screws on items requiring assembly by screws or as indicated.

.3 Where possible, fit and shop assemble work, ready for erection.

.4 Ensure exposed welds are continuous for length of each joint. File or grind exposed welds smooth and flush.

2.4 Finishes

.1 Galvanizing: Hot dipped galvanizing with zinc coating 600 g/m2 to CAN/CSA G164.

.2 Shop coat primer: MPI-EXT 5.1B.

.3 Zinc primer: Zinc rich, ready mix to CAN/CGSB 1.181.

2.5 Isolation Coating

.1 Isolate aluminum from following components, by means of bituminous paint:

.1 Dissimilar metals except stainless steel, zinc, or white bronze of small area.

.2 Concrete, mortar and masonry.

.3 Wood.

2.6 Shop Painting

.1 Apply one shop coat of primer to metal items, with exception of galvanized or concrete encased items.

.2 Use primer unadulterated, as prepared by manufacturer. Paint on dry surfaces, free from rust, scale, and grease. Do not paint when temperature is lower than 7°C.

.3 Clean surfaces to be field welded; do not paint.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for metal fabrication installation in accordance with manufacturer's written instructions.

- .1 Visually inspect substrate.
- .2 Inform Departmental Representative of unacceptable conditions.
- .3 Proceed with installation only after unacceptable conditions have been remedied

3.2 Erection

.1 Perform welding work in accordance with CSA W59 unless specified otherwise.

.2 Erect metalwork square, plumb, straight, and true, accurately fitted, with tight joints and intersections.

.3 Provide suitable means of anchorage acceptable to Design-Builder such as dowels, anchor clips, bar anchors, expansion bolts and shields, and toggles.

.4 Exposed fastening devices to match finish and be compatible with material through which they pass.

.5 Supply components for work by other trades in accordance with shop drawings and schedule.

.6 Make field connections with bolts to CSA S16, or weld.

.7 Deliver items over for casting into concrete and building into masonry together with setting templates to appropriate location and construction personnel.

.8 Touch-up rivets, field welds, bolts and burnt or scratched surfaces with zinc rich primer.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American National Standards Institute/National Particleboard Association (ANSI/NPA)

.1 ANSI/NPA A208.1-2009, Particleboard.

.2 ASTM International

.1 ASTM A123/A123M-13, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

.2 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galv-anealled) by the Hot-Dip Process.

.3 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet for Use in Building Construction and amendment.

.4 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA O112.9-10 (R2014), Evaluation of Adhesives for Structural Wood Products (Exterior Exposure).

.3 CSA O121-08 (R2013), Douglas Fir Plywood.

.4 CSA O141-05 (R2014), Softwood Lumber.

.5 CSA O151-09 (R2014), Canadian Softwood Plywood.

.6 CSA O153-13, Poplar Plywood.

.7 CSA O325-07 (R2012), Construction Sheathing.

.5 National Lumber Grades Authority (NLGA)

.1 NLGA Standard Grading Rules for Canadian Lumber (2014 edition).

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for wood products and accessories. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in BC, Canada.

1.4 Quality Assurance

.1 Lumber by grade stamp of an agency certified by Canadian Lumber Standards Accreditation Board.

.2 Plywood, particleboard, OSB, and wood based composite panels in accordance with CSA and ANSI standards.

PART 2 PRODUCTS

2.1 Framing, Structural and Panel Materials

.1 Lumber: Softwood, S4S, moisture content 19% (S-dry) or less in accordance with following standards:

.1 CSA O141.

.2 NLGA Standard Grading Rules for Canadian Lumber.

.2 Furring, blocking, nailing strips, grounds, rough bucks, cants, curbs, fascia backing and sleepers:

.1 Use S2S or S4S materials.

.2 Board sizes: "Standard" or better grade.

.3 Dimension sizes: "Standard" light framing or better grade.

.4 Post and timbers sizes: "Standard" or better grade.

.3 Plywood, OSB and wood based composite panels: CSA O325.

.4 Douglas fir plywood (DFP): CSA O121, standard construction.

.5 Canadian softwood plywood (CSP): CSA O151, standard construction.

.6 Poplar plywood (PP): CSA O153, standard construction

2.2 Accessories

.1 Polyethylene film: To CAN/CGSB 51.34, Type 1, 0.15 mm thick.

.2 Air seal: Closed cell polyurethane or polyethylene.

.3 General purpose adhesive: CSA O112.9.

.4 Nails, spikes and staples: CSA B111.

.5 Bolts: 12.5 mm diameter unless indicated otherwise, complete with nuts and washers.

.6 Proprietary fasteners: Toggle bolts, expansion shields and lag bolts, screws and lead or inorganic fibre plugs, recommended for purpose by manufacturer.

.7 joist hangers: Minimum 1 mm thick sheet steel, galvanized ZF001 coating designation.

.8 Fasteners: Hot dipped galvanized steel to ASTM A123/A123M or ASTM A653/A653M for high humidity and treated wood locations, unfinished steel elsewhere.

.9 Wood Preservative:

.1 Preservative: In accordance with manufacturer's recommendations for surface Conditions:

2.3 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect wood from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for rough carpentry installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Framing

.1 Select exposed framing for appearance. Install lumber and panel materials so that grademarks and other defacing marks are concealed or are removed by sanding where materials are left exposed.

.2 Make provisions for erection loads, and for sufficient temporary bracing to maintain structure safe, plumb, and in true alignment until completion of erection and installation of permanent bracing.

.3 Install members true to line, levels and elevations, square and plumb.

.4 Construct continuous members from pieces of longest practical length.

.5 Construct framing and curb members full length without splices.

.6 Install spanning members with "crown-edge" up.

.7 Construct double joist headers at floor and ceiling openings and under wall stud partitions that are parallel to floor joists. Frame rigidly into joists.

.8 Frame, anchor, fasten, tie, and brace members to provide necessary strength and rigidity.

.9 Countersink bolts where necessary to provide clearance for other work.

3.3 Furring and Blocking

.1 Install furring and blocking as required to space-out and support casework, cabinets, wall and ceiling finishes, siding, electrical equipment mounting boards, and other work as required.

.2 Install furring to support siding applied vertically where there is no blocking and where sheathing is not suitable for direct nailing.

.3 Align and plumb faces of furring and blocking to tolerance of 1:600.

.4 Install rough bucks, nailers, and linings to rough openings as required to provide backing for frames and other work.

.5 Install wood cants, fascia backing, nailers, curbs, and other wood supports as required and secure using galvanized steel fasteners.

.6 Install sleepers as required.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM C518-10, Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.

.2 ASTM C591-13, Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation.

.3 ASTM C665-12, Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing.

.4 ASTM C726-12, Standard Specification for Mineral Wool Roof Insulation Board.

.5 ASTM C1289-14a, Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.

.6 ASTM D1621-10, Standard Test Method for Compressive Properties of Rigid Cellular Plastics.

.7 ASTM D1622/D1622M-14, Standard Test Method for Apparent Density of Rigid Cellular Plastics.

.8 ASTM D1623-09, Standard Test Method for Tensile and Tensile Adhesion Properties of Rigid Cellular Plastics.

.9 ASTM D6226-10, Standard Test Method for Open Cell Content of Rigid Cellular Plastics.

.10 ASTM E96/E96M-14, Standard Test Methods for Water Vapour Transmission of Materials.

.11 ASTM E2178-13, Standard Test Method for Air Permeance of Building Materials.

.2 Canadian General Standards Board (CGSB)

.1 CGSB 71-GP-24M, Adhesive, Flexible, for Bonding Cellular Polystyrene Insulation.

.2 CGSB 51.23-92 - Spray Applied Rigid Polyurethane Cellular Plastic Thermal Insulation.

.3 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

.2 CSA B149.1-10, Natural Gas and Propane Installation Code.

.3 CSA B149.2-10 (R2015), Propane Storage and Handling Code.

.4 Underwriters Laboratories of Canada (ULC)

.1 CAN/ULC S102-10, Standard Method of Test for Surface Burning Characteristics of Building Materials and Assemblies.

.2 CAN/ULC S107-10, Methods of Fire Tests of Roof Coverings.

.3 CAN/ULC S127-14, Standard Corner Wall Method of Test for Flammability Characteristics of Non-Melting Foam Plastic Building Materials.

.4 CAN/ULC S604-M91, Standard for Factory Built Type A Chimneys.

.5 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Coverings.

.6 CAN/ULC S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.7 CAN/ULC S704-11, Standard for Thermal Insulation Polyurethane and

Polyisocyanurate, Boards, Faced.

.8 CAN/ULC 705.1-01, Standard for Thermal Insulation – Spray Applied Rigid

Polyurethane Foam, Medium Density – Material – Specification.

.9 CAN/ULC S705.2-05, Standard for Thermal Insulation – Spray Applied Rigid

Polyurethane Foam, Medium Density – Application.

.10 CAN/ULC S770-09, Standard Test Method for Determination of Long-Term Thermal Resistance of Closed-Cell Thermal Insulating Foams.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 26 00 – Vapour Barriers

.3 Section 07 27 00 – Air Barriers

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and data sheets.

.2 Manufacturer's Instructions:

.1 Submit manufacturer's installation instructions.

.3 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties.

.4 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.4 Quality Assurance

.1 Spray Foam Installer Qualifications: Applicators to be licensed and certified by the SPF Quality Assurance Program used by CUFCA.

.2 Regulatory Requirements:

.1 Spray Foam:

.1 Conform to applicable code for flame and smoke requirements.

.2 CAN/ULC S107: Class A Fire Hazard Classification.

PART 2 PRODUCTS

2.1 Board Insulation

.1 Rigid insulation: Extruded closed cell polystyrene (XPS): To CAN/ULC S701, rigid board; for foundations, roofing, or walls.

.1 Type: 4.

.2 Compressive strength to ASTM D1621: Minimum 210 kPa.

.3 Thermal resistance to ASTM C518: RSI 0.88/25 mm.

.4 Water absorption to ASTM D2842: Maximum 0.7%.

2.2 Batt Insulation

.1 Thermal batt insulation: To CAN/ULC S702, mineral/glass fibre, friction fit, formaldehyde free; for exterior walls, floors, and ceilings.

.1 Type: 1.

.2 Surface burning characteristics to ASTM E84:

.1 Flame spread: ≤ 25.

.2 Smoke developed: ≤ 50.

.3 Acoustic batt insulation: To CAN/ULC S702; to ASTM E90 for airborne sound transmission loss and to ASTM E413 sound transmission class; for sound rated partitions and floors.

2.3 Spray Foam Insulation

.1 Polyurethane foam insulation: To CAN/ULC S705.1, two component spray applied polyurethane, medium density, closed cell foam.

.1 Density to ASTM D1622: 38 kg/m3.

.2 Long Term Thermal Resistance to CAN/ULC S770: 1.0 m^2•K/W per 25 mm.

.3 Water Vapor Permeance at 50 mm to ASTM E96: 34 ng/Pa•s. •m^2

.4 Air Permeance at 35 mm to ASTM E2178: 0.0005 L/s•m^2

.5 Compressive Strength to ASTM D1621: 262 kPa.

.6 Tensile Strength to ASTM D1623: 283 kPa.

.7 Off Gassing Test (VOC Emissions) to CGSB 51.23: Pass (no toxic vapor).

.8 Surface Burning Characteristics:

.1 Flame Spread Index to CAN/ULC S127: 340.

.2 Smoke Developed Index to CAN/ULC S102: 325.

.9 Open Cell Content by volume to ASTM D6226: 2%.

		.2	Foam sealant: VOC compliant one-component, low expansion, post-expanding polyurethane foam.
2.4	Adhesive	.1	Adhesive (for polystyrene): To CGSB 71-GP-24.
2.5	Accessories	.1	Insulation clips: Impale type, perforated 50 x 50 mm cold rolled carbon steel 0.8 mm thick, adhesive back, spindle of 2.5 mm diameter annealed steel, length to suit insulation, 25 mm diameter washers of self locking type.
		.2	Nails: Galvanized steel, length to suit insulation plus 25 mm, to CSA B111.
		.3	Staples: 12 mm minimum leg.
		.4	Tape: As recommended by manufacturer.
2.6	Delivery, Storage and Handling	.1	Deliver materials in manufacturer's original containers clearly labelled with manufacturer's name, product identification, safety information, net weight of contents and expiration date.
		.2	Store material in a safe manner and where the temperatures are within range specified by manufacturer.

PART 3 EXECUTION

3.1	Manufacturer's Instructions	.1	Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.
3.2	Examination	.1	Verify conditions of substrate are acceptable for insulation installation in accordance with manufacturer's written instructions.
			.1 Visually inspect substrate in presence of Departmental Representative.
			.2 Inform Departmental Representative of unacceptable conditions.
			.3 Proceed with installation only after unacceptable conditions have been remedied.
3.3	General	.1	Install insulation after building substrate materials are dry.

		.2	Install insulation to maintain continuity of thermal protection to building elements and spaces.
		.3	Fit insulation tight around electrical boxes, plumbing and heating pipes and ducts, around exterior doors and windows and other protrusions.
		.4	Keep insulation minimum 75 mm from heat emitting devices such as recessed light fixtures, and minimum 50 mm from sidewalls of CAN/ULC S604 type A chimneys and CSA B149.1 and CSA B149.2 type B and L vents.
		.5	Cut and trim insulation neatly to fit spaces. Butt joints tightly, offset vertical joints. Use only insulation boards free from chipped or broken edges. Use largest possible dimensions to reduce number of joints.
		.6	Offset both vertical and horizontal joints in multiple layer applications.
3.4	Examination	.1	Examine substrates and inform Departmental Representative in writing of defects.
		.2	Verify substrates are firm, straight, smooth, dry, free of snow, ice or frost, and clean of dust and debris.
		.3	Verify acoustic and firestop sealants required at stud framing junctions with adjacent building components or at mechanical and electrical conduit and duct penetrations are installed.
		.4	Confirm mechanical, electrical and telecommunications service lines in walls, floors, and ceilings to be insulated have been inspected.
3.5	Preparation	.1	Spray foam insulation: Mask and protect adjacent surfaces from over-spray or dusting.
3.6	Board Insulation Installation	.1	Apply adhesive in accordance with manufacturer's recommendations.

		.2	Install mineral fibre insulation boards with insulation clips and disk, 2 per 600 x 1200 mm board minimum, fit boards tight, cut off fastener spindle 3 mm beyond disk.
		.3	Leave insulation board joints unbonded over line of expansion and control joints.
3.7	Batt Insulation Installation	.1	Install insulation to maintain continuity of thermal protection to building elements and spaces.
		.2	Install acoustic insulation where indicated to maintain sound attenuation of separation in building elements and spaces.
		.3	Place acoustic blankets between studs ensuring friction fit, free of sags, folds, voids, or open joints that may let sound pass through.
		.4	Fit insulation closely around electrical boxes, pipes, ducts, frames and other objects in or passing through insulation.
		.5	Do not compress insulation excessively to fit voids.
		.6	Do not enclose insulation until it has been inspected and approved by Departmental Representative.
3.8	Spray Applied Foam Installation	.1	Install polyurethane foam to CAN/ULC S705.2.
		.2	Do not apply spray foam to wet or damp substrate.
		.3	Apply by spray method to uniform monolithic density without voids.
		.4	Apply foam to maximum 50 mm thickness per pass. Allow for cooling between application passes, to manufacturer's recommendations.
3.9	Project Conditions	.1	Maintain environmental conditions of temperature, humidity, and ventilation within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
		.2	Ventilate area to receive insulation to maintain safe working conditions.

END OF SECTION

PART 1 GENERAL

1.1 References
.1 Canadian General Standards Board (CGSB)
.1 CAN/CGSB 51.34-M86, Vapour Barrier, Polyethylene Sheet, for Use in Building Construction.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures
.2 Section 07 21 00 – Building Insulation

1.3 Submittals
.1 Product data:
.1 Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, and limitations.
.2 Quality assurance submittals:
.1 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.2 Instructions: Submit manufacturer's installation instructions and comply with written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheet.

1.4 Quality Assurance
.1 Mock-Ups:
.1 Construct mock-up of sheet vapour barrier installation including one lap joint, one inside corner and at one electrical box. Mock-up may be part of finished work.
.2 Mock-up will be used to judge workmanship, substrate preparation, and material application.
.3 Locate where directed.
.4 Allow for review of mock-up by Departmental Representative before proceeding with vapour barrier work.
.2 When accepted, mock-up will demonstrate minimum standard of quality required for this work.

.3 Reviewed mock-up may remain as part of finished work.

PART 2 PRODUCTS

2.1 Sheet Vapour Barrier

.1 Polyethylene film: To CAN/CGSB 51.34, minimum 0.25 mm thick for underneath utilidor plywood floor.

2.2 Accessories

.1 Joint sealing tape: Air resistant pressure sensitive adhesive tape, type recommended by vapour barrier manufacturer, 50 mm wide for lap joints and perimeter seals, 25 mm wide elsewhere.

.2 Sealant: Compatible with vapour retarder materials, recommended by vapour retarder manufacturer.

.3 Staples: Minimum 6 mm leg.

.4 Moulded box vapour barrier: Factory-moulded polyethylene box for use with recessed electric switch and outlet device boxes.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for vapour retarder installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

.1 Ensure services are installed and inspected prior to installation of retarder.

.2 Install sheet vapour retarder on warm side of exterior assemblies prior to installation of gypsum board to form continuous retarder.

.3 Use sheets of largest practical size to minimize joints.

.4 Inspect for continuity. Repair punctures and tears with sealing tape before work is concealed.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM D412-06a (2013), Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers – Tension.

.2 ASTM E96/E96M-14, Standard Test Methods for Water Vapor Transmission of Materials.

.3 ASTM E283-04 (2012), Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

.4 ASTM E23 57-11, Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 37-GP-56M, Membrane, Modified, Bituminous, Prefabricated, and Reinforced for Roofing.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 21 00 – Building Insulation

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature, specifications and datasheets. Include product characteristics, performance criteria, physical size, finish and limitations.

1.4 Quality Assurance

.1 Mock-Up:

.1 Construct typical exterior wall panel, incorporating window frame and sill, insulation, building corner condition, junction with roof system; illustrating materials interface and seals.

.2 Locate where directed.

.3 Allow for review of mock-up by Departmental Representative.

.4 Reviewed mock-up may remain as part of finished work.

1.5	Sequencing	.1	Sequence work to permit installation of materials in conjunction with related materials and seals.

PART 2 PRODUCTS

2.1	Sheet Materials	.1	Self-adhering air/vapour barrier membrane, SBS modified bitumen complete with crosslaminated polyethylene film, to ASTM E2357.

.1 Physical properties:

.1 Thickness: 1.0 mm.

.2 Air leakage to ASTM E283: <0.005 L/s•m^2 at 75 Pa.

.3 Water vapour permeance to ASTM E96: 1.6 ng/Pa•s•m2.

.4 Low temperature flexibility to CGSB 37-GP-56M: -40°C.

.5 Elongation to ASTM D412-modified: 200%.

2.2	Sealants	.1	Sealants and primers: As recommended by membrane manufacturer.
2.3	Delivery, Storage and Handling	.1	Deliver, store, and handle materials in accordance with manufacturer's written instructions.

PART 3 EXECUTION

3.1	Manufacturer`s Instructions	.1	Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
3.2	Examination	.1	Verify conditions of substrate are acceptable for air barrier installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.3 Preparation

.1 Remove loose or foreign matter that might impair adhesion of materials.

.2 Ensure substrates are clean of oil or excess dust; masonry joints struck flush, and open joints filled; and concrete surfaces free of large voids, spalled areas, or sharp protrusions.

.3 Ensure substrates are free of surface moisture prior to application of self-adhesive membrane and primer.

.4 Ensure metal closures are free of sharp edges and burrs.

.5 Prime substrate surfaces to receive membrane in accordance with manufacturer's instructions.

3.4 Ambient Conditions

.1 Install solvent curing sealants and vapour release adhesive materials in open spaces with ventilation.

.2 Ventilate enclosed spaces.

.3 Maintain temperature and humidity recommended by materials manufacturer before, during, and after installation.

3.5 Installation

.1 Install materials in accordance with manufacturer's instructions.

.2 Apply sealant within recommended application temperature ranges.

.1 Consult manufacturer when sealant cannot be applied within these temperature ranges.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American Society of Mechanical Engineers (ASME)

.1 ASME B18.6.3-2013, Machine Screws, Tapping Screws, and Metallic Drive Screws (Inch Series).

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.32-M77, Sheathing, Membrane, Breather Type.

.2 CAN/CGSB 93.4-92, Galvanized and Aluminum-Zinc Alloy Coated Steel Siding Soffits and Fascia, Prefinished, Residential.

.3 CAN/CGSB 93.5-92, Installation of Metal Residential Siding, Soffits and Fascia.

.3 Canadian Standards Association (CSA)

.1 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 92 00 – Joint Sealants

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for metal siding and include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.

.2 Indicate dimensions, profiles, attachment methods, schedule of wall elevations, trim and closure pieces, soffits, fascia, metal furring, and related work.

.3 Samples:

.1 Submit duplicate 200 x 200 mm samples of proposed siding material.

1.4	Quality Assurance	.1	Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
		.2	Certificates: Submit product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

PART 2 PRODUCTS

2.1	Steel Cladding and Components	.1	Strip siding: To CAN/CGSB 93.4, Type vertical, Class plain.
			.1 Colour: Match Existing.
			.2 Profile: Preformed interlocking joints, fastener holes prepunched.
		.2	Soffit: To CAN/CGSB 93.4.
			.1 Colour: Match Existing
			.2 Gloss: Medium.
			.3 Profile: Flat sheet 'V' crimped for stiffness.
		.3	Fascia facings and exposed trim: to CAN/CGSB 93.4, Class plain:
			.1 Colour: Match Existing.
			.2 Gloss: Medium.
			.3 Profile: Manufacturer's standard.
2.2	Fastners	.1	Nails: CSA B111.
		.2	Screws: ASME B18.6.3. Purpose made stainless steel.
2.3	Caulking	.1	Sealants: In accordance with Section 07 92 00 - Joint Sealants.
2.4	Sheathing Paper	.1	Exterior wall sheathing paper: To CAN/CGSB 51.32.
2.4	Sheathing Paper	.1	Exposed trim: Inside corners, outside corners, cap strip, drip cap, undersill trim, starter strip and window/door trim of same material, colour, and gloss as cladding, with fastener holes pre-punched.

2.5 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, with manufacturer's labelling.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect metal siding from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for metal siding installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied

3.2 Manufacturer's Instructions

.1 Comply with manufacturer's written data, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

3.3 Installation

.1 Install cladding in accordance with CGSB 93.5, and manufacturer's written instructions.

.2 Maintain joints in exterior cladding, true to line, tight fitting, hairline joints.

.3 Attach components in manner not restricting thermal movement.

.4 Caulk junctions with adjoining work with sealant.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International
- .1 ASTM A53/A53M-12, Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated, Welded and Seamless.
- .2 ASTM A108-13, Specification for Steel Bars, Carbon, Cold-Finished, Standard Quality.
- .3 ASTM A325-14, Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.
- .4 ASTM A500/A500M-13, Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes.
- .5 ASTM A615/A615M-15, Specification for Deformed and Plain Billet Steel Bars for Concrete Reinforcement.
- .6 ASTM C33/C33M-13, Specification for Concrete Aggregates.

.2 Canadian Institute of Steel Construction (CISC).
- .1 CISC Limit States Design in Structural Steel.

.3 Canadian Standards Association (CSA)
- .1 CAN/CSA-G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel, Structural Quality Steel
- .2 CAN/CSA O86-14, Engineering Design in Wood.
- .3 CAN/CSA O141-05 (2014), Softwood Lumber.
- .4 CSA O151-09 (R2014), Canadian Softwood Plywood.
- .5 CAN/CSA S16-14, Design of Steel Structures.
- .6 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Sheet Steel Building Institute (CSSBI).

.5 Engineered Wood Association (formerly American Plywood Association, APA).

.6 Intertek Warnoch-Hersey (IWH).
- .1 Certified Listings.

.7 Metal Framing Manufacturers Association (MFMA).
- .1 Guidelines for the Use of Metal Framing.

.8 National Lumber Grades Authority (NLGA).
- .1 NLGA Standard Grading Rules for Canadian Lumber, 2014.

.12 Underwriters Laboratories of Canada (ULC).

.1 List of Equipment and Materials - Fire Resistance.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 21 00 – Building Insulation

.3 Section 07 61 00 –Sheet Metal Roofing

1.3 Design and Performance Requirements

.1 Performance Requirements: Design and Supply a roof system by nominated specialist contractor and construct roof system based on rafters in full compliance with current building regulations to provide the roof profile and metal finish as indicated on the design drawings.

.1 Submit roof system design, signed and sealed by a Professional Engineer registered in the Province of British Columbia, in accordance with Section 01 33 00 - Submittal Procedures.

.2 Provide roofing structure and substrate capable of withstanding effects of loads and stresses within limits and under conditions required by code and referenced standards.

.3 Provide simple, uncomplicated roof shapes that minimize snow and ice accumulation.

.4 Design to current design data and standards for Rogers Pass, British Columbia, and to Structural Engineer's technical specifications.

.1 Wind loads.

.2 Snow loads.

.3 Roof loads.

.4 Seismic zone.

.5 Deflection of roof.

.6 Deflection of supporting members.

.7 Maximum allowable deflection of flat or sloped decking.

.5 Fire Resistance Rating: In accordance with Building Code classification.

1.4 Description

.1 Structural Steel:

.1 Design Requirements: CISC Limit States Design.

.2 Metal or Wood Roof Decking:

.1 Design deck layout, spans, fastening, and joints.

.2 Calculate structural stress design and maximum vertical deck deflection of 1:240.

.3 Design to provide movement of components without damage, failure of joint seals, undue stress on fasteners, or other detrimental effects when subject to temperature ranges.

.3 Wood Framing:

.1 Design, engineer, and fabricate structural framing, temporary shoring and bracing to conform to design and code requirements.

1.5 Quality Standards

.1 Structural Steel:

.1 Design: CSA S16.

.2 Cold Formed Metal Framing: calculate structural properties of framing members to:

.1 CSSBI requirements.

.2 AWCI - Specifications Guide.

.3 MFMA - Guidelines.

.3 Dimension Lumber Framing:

.1 Wood Member Design: CAN/CSA O86 - Working Stress.

.2 Lumber Grading Rules: NLGA.

.3 Plywood Grading Agency: APA.

.4 Wood Lumber Trusses:

.1 Wood Member Design: CAN/CSA O86, limited stress.

.2 Metal Plates in accordance to ANSI/TPI-1.

.3 Lumber Grading Rules: NLGA.

.4 Plywood Grading Agency: APA.

1.6 Submittals

.1 Product Data: Provide manufacturer's data on material characteristics, performance criteria, and limitations

.2 Manufacturer's Installation Instructions: Indicate preparation

.3 Test Reports: Certified test reports showing compliance with specified performance characteristics and physical properties

.4 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

1.7 Quality Assurance

.1 Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum ten (10) years' documented experience.

.2 Installer Qualifications: Company specializing in performing the work of this section with minimum five (5) years' experience, and approved by the manufacturer.

PART 2 PRODUCTS

2.1 Structural Steel

.1 Products:

.1 Structural Steel Members: CSA G40.20/G40.21.

.2 Structural Tubing: ASTM A500, Grade B.

.3 Pipe: ASTM A53/A53M, Grade B.

.2 Accessories:

.1 Shear Stud Connectors: ASTM A108, forged steel, headed, unfinished.

.2 Welding Materials: CSA W59.

.3 Fabrication:

.1 Fabricate members to CISC requirements.

.2 Shop Assembly: Fabricate to the degree necessary to accomplish effective site erection without cutting or modification to framing members.

.3 Shop/Factory Finishing: Shop primed.

2.2 Cold Formed Metal Framing

.1 Joists and Purlins: Sheet steel, channel shape, solid web.

.2 Accessories:

.1 Plates, Gussets, Clips: Sheet steel, thickness determined for conditions encountered.

.2 Fasteners: Self-drilling, self-tapping screws, bolts, nuts and washers, galvanized.

.3 Welding: CSA W59.

.3 Fabrication:

.1 Shop Assembly: Fit and assemble in sections ready for site installation.

.2 Shop/Factory Finishing: Primed.

2.3 Wood Framing and Sheathing

.1 Dimension Lumber Framing:

.1 Framing: select structural No. 1/No. 2 grade.

.2 Species: Spruce/Pine/Fir.

.3 Exposed framing: appearance grade.

.2 Wood Trusses:

.1 Lumber: Softwood lumber of fabricators choice to suit grading rules and load requirements.

.2 Connectors: Graded by APA.

.3 Steel Connectors: Die stamped with integral teeth, galvanized.

.4 Truss Bridging: Type, size and spacing recommended by truss manufacturer.

.5 Accessories:

.1 Wood Blocking and Plate Members: Softwood lumber, S-P-F species, construction grade.

.2 Fasteners and Anchors: Hot dipped galvanized steel.

.3 Bearing Plates: Steel.

.6 Fabrication:

.1 Fabricate trusses to achieve structural requirements.

.2 Provide bottom and top chord extensions where noted on structural drawings.

.3 Brace wood trusses for support during transit.

.4 Fabricate to achieve minimum end bearing on supports.

.7 Treatment:

.1 Fire Retardant Treatment: AWPA C20, Interior Type.

.3 Roof Sheathing:

.1 Plywood Sheathing: CSA O151.1.

.2 Gypsum Sheathing: Square.

.4 Wood Decking:

.1 Lumber Decking: CSA O141 species, exterior grade, single tongue.

.5 Accessories:

.1 Building Paper: No. 15 asphalt felt.

PART 3 EXECUTION

3.1 Installation-General

.1 Ensure roof assemblies are installed in an independent manner that will minimize damage to adjacent installations during repair, removal or disassembly.

.2 Leave connections exposed or accessible.

.3 Attach materials to facilitate future disassembly, deconstruction, reuse and recycling.

.4 Isolate materials from adjacent materials to minimize contamination and to facilitate future disassembly, deconstruction, reuse and recycling.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM D523-14, Standard Test Method for Specular- Gloss.

.3 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 37.29-M89, Rubber-Asphalt Sealing Compound.

.2 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.

.3 Canadian Roofing Contractors Association (CRCA)

.1 Canadian Roofing Reference Manual.

.2 Roofing Specifications Manual.

.4 Canadian Standards Association (CSA)

.1 CSA A123.3-05 (R2010), Asphalt Saturated Organic Roofing Felt.

1.1 Performance/ Design Requirements

.1 Design complete roof system to withstand dead loads, snow loads and build-up, and wind loads including uplift calculated in accordance with applicable Codes and applicable local regulations.

.2 Metal roofing system to include underlying waterproof membrane providing drainage to exterior. Seal fasteners through this membrane to ensure watertight system.

.3 Design roof to allow adequate provision for contraction and expansion, in accordance with manufacturer's recommendations.

.4 Design anchorage, method of fastening, frequency of clips and spacing, and number of fasteners for fixing roofing materials to meet loading requirements, including but not limited to suction loads.

.5 Design panel width dimensions and thickness details in accordance with roofing manufacturer's recommendations to

avoid fluttering and subsequent cracking.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures
.2 Section 07 50 00 – Roof Construction

1.3 Submittals
.1 Product Data:
.1 Submit manufacturer's instructions, printed product literature and data sheets for sheet metal roofing and include product characteristics, performance criteria, physical size, finish and limitations.
.2 Shop Drawings:
.1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.
.3 Samples:
.1 Submit duplicate 200 x 200 mm samples of each sheet metal material.

1.4 Quality Assurance
.1 Perform work in accordance with CRCA standards.
.2 Mock-ups:
.1 Fabricate sample roofing panel using identical project materials and methods to include typical seam.
.2 Mock-up will be used:
.1 To judge workmanship, substrate preparation, operation of equipment, and material application.
.3 Locate where directed by Departmental Representative
.4 Allow for review of mock-up by Departmental Representative before proceeding with sheet metal flashing work.
.5 Reviewed mock-up may remain as part of finished Work

1.5 Compatibility
.1 Compatibility between metal flashings components is essential. Materials to be incorporated into system must be compatible.
.2 Provide written declaration that installed metal flashings

comply with CRCA Standards.

PART 2 PRODUCTS

2.1 Sheet Metal Materials

.1 Zinc coated steel sheet: to ASTM A653/A653M, commercial quality, with Z275 coating, smooth surface, 22 gauge minimum base metal thickness.

.2 Factory applied polyvinylidene fluoride:

.1 Colour selected by from manufacturer's standard range.

.2 Specular gloss: 30 ± 5 units, to ASTM D523.

.3 Coating thickness: 22 micrometres minimum.

.4 Resistance to accelerated weathering for chalk rating of 8, colour fade 5 units or less and erosion rate less than 20% to ASTM D822 as follows:

.1 Outdoor exposure period 2500 hours minimum.

.2 Humidity resistance exposure period 5000 hours minimum.

2.2 Accessories

.1 Isolation coating: Alkali resistant bituminous paint.

.2 Plastic cement: To CAN/CGSB 37.5.

.3 Underlay: No.15 perforated asphalt felt to CSA A123.3.

.4 Slip sheet: Reinforced sisal paper or a heavy felt kraft paper.

.5 Sealant: Asbestos-free sealant, compatible with systems materials, recommended by system manufacturer.

.6 Rubber-asphalt sealing compound: To CAN/CGSB 37.29.

.7 Fasteners: Concealed.

.8 Washers: Same material as sheet metal, 1 mm thick with rubber packings.

.9 Touch-up paint: As recommended by sheet metal roofing manufacturer

2.3 Fabrication

.1 Hem exposed edges on underside 12 mm, mitre and seal.

.2 Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.

.3 Apply minimum 0.2 mm dry film thickness coat of plastic

cement to both faces of dissimilar metals in contact.

2.4 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect sheet metal roofing from nicks, scratches, and blemishes.

.3 Replace defective or damaged materials with new.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for sheet metal roofing installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Installation

.1 Use concealed fastenings except where approved by Departmental Representative before installation.

.2 Stagger transverse seams in adjacent panels.

.3 Flash roof penetrations with material matching roof panels, and make watertight.

.4 Form seams in direction of water-flow and make watertight.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 The Aluminum Association Inc. (AAI)
- .1 AAI DAF 45-2003 (R2009), Designation System for Aluminum Finishes.

.2 ASTM International
- .1 ASTM A653/A653M-13, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
- .2 ASTM D523-14, Standard Test Method for Specular Gloss.
- .3 ASTM D822/D822M-13, Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings.

.3 Canadian Roofing Contractors Association (CRCA)
- .1 Roofing Specifications Manual, current edition.

.4 Canadian General Standards Board (CGSB)
- .1 CAN/CGSB 37.5-M89, Cutback Asphalt Plastic Cement.

.5 Canadian Standards Association (CSA)
- .1 CSA A123.3-05 (R2010), Asphalt Saturated Organic Roofing Felt.
- .2 CSA B111-1974 (R2003), Wire Nails, Spikes and Staples.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 50 00 – Roof Construction

.3 Section 07 61 00 – Sheet Metal Roofing

1.3 Submittals

.1 Product Data:
- .1 Submit manufacturer's printed product literature for sheet metal flashing systems materials, specifications and datasheets. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Shop Drawings:
- .1 Shop drawings: Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia, Canada.

.3 Samples:

.1 Submit duplicate 100 x 100 mm samples of each type of sheet metal material, finishes, and colours.

.4 Quality assurance submittals:

.1 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

1.4 Warranty

.1 Eavestroughs: Minimum 10 year manufacturer warranty.

PART 2 PRODUCTS

2.1 Sheet Metal Materials

.1 Zinc coated steel sheet: Commercial quality to ASTM A653/A653M, with Z275 designation zinc coating.

2.2 Prefinished Steel Sheet

.1 Prefinished steel with factory applied polyvinylidene fluoride.

.1 Colour: Selected by Owner from manufacturer's standard range.

.2 Specular gloss: 30 units +/- in accordance with ASTM D523.

.3 Coating thickness: Minimum 22 micrometres.

2.3 Accessories

.1 Isolation coating: Alkali resistant bituminous paint.

.2 Plastic cement: to CAN/CGSB 37.5.

.3 Underlay for metal flashing: No. 15 perforated asphalt felt to CSA A123.3.

.4 Cleats: Same material and temper as sheet metal, minimum 50 mm wide. Thickness: Same as sheet metal being secured.

.5 Fasteners: Same material as sheet metal, to CSA B111, flat head roofing nails of length and thickness suitable for metal flashing application.

.6 Washers: Same material as sheet metal, 1 mm thick with rubber packings.

.7 Touch-up paint: as recommended by prefinished material manufacturer.

2.4	Fabrication	.1	Fabricate metal flashings and other sheet metal work in accordance with applicable CRCA 'FL' series details.
		.2	Fabricate aluminum flashings and other sheet aluminum work in accordance with AAIAluminum Sheet Metal Work in Building Construction.
		.3	Form pieces in 2400 mm maximum lengths.
			.1 Make allowance for expansion at joints.
		.4	Hem exposed edges on underside 12 mm.
			.1 Mitre and seal corners with sealant.
		.5	Form sections square, true and accurate to size, free from distortion and other defects detrimental to appearance or performance.
		.6	Apply isolation coating to metal surfaces to be embedded in concrete or mortar.
2.5	Metal Flashings	.1	Form flashings, copings, and fascias of galvanized steel to profiles indicated.
2.6	Reglets and Cap Flashings	.1	Form reglets of 24 gauge sheet aluminum for base flashings in accordance with CRCA FL series details.
			.1 Provide slotted fixing holes and steel/plastic washer fasteners.
2.7	Eavestroughs and Downpipes	.1	Form eavestroughs and downpipes from aluminum, minimum 24 gauge.
		.2	Provide goosenecks, outlets, strainer baskets and necessary fastenings.
		.3	Provide high quality hangers with screw attachment.
2.8	Scuppers	.1	Form scuppers from aluminum, minimum 24 gauge.
		.2	Provide necessary fastenings.
2.9	Aluminum Finishes	.1	Finish exposed surfaces of aluminum components in accordance with AA DAF 45.

2.10 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1 Examination

.1 Verify existing conditions before starting work.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.2 Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

.3 Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 Preparation

.1 Install starter and edge strips, and cleats before starting sheet metal installation.

3.3 Installation

.1 Install sheet metal work in accordance with CRCA Roofing Specifications Manual.

.2 Secure flashings in place using concealed fasteners. Use exposed fasteners only where permitted.

.3 Fit flashings tightly in place. Make corners square, surfaces true and straight in planes, and lines accurate to profiles.

.4 Counterflash bituminous flashings at intersections of roof with vertical surfaces and curbs.

.1 Flash joints using S-joints forming tight fit over hook strips.

.5 Lock end joints and caulk with sealant.

.6 Install surface mounted reglets true and level, and caulk top of reglet with sealant.

.7 Insert metal flashing into reglets to form weather tight junction.

		.8	Turn top edge of flashing into recessed reglet or mortar joint minimum of 25 mm. Lead wedge flashing securely into joint.
		.9	Caulk flashing at reglet with sealant.
		.10	Install pans, where shown around items projecting through roof membrane.
3.4	Eavestroughs and Downpipes	.1	Install eavestroughs and secure to building at 450 mm on centre with purpose-made eavestrough screws through brackets.
			.1 Slope eavestroughs to downpipes.
			.2 Seal joints watertight.
		.2	Install downpipes and provide goosenecks back to wall.
			.1 Secure downpipes to wall with straps at 1800 mm on centre; minimum two straps per downpipe.
		.3	Install concrete splash pads.
3.5	Scuppers	.1	Install scuppers as required.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM C834-14, Standard Specification for Latex Sealants.

.2 ASTM C919-12, Standard Practice for Use of Sealants in Acoustical Applications.

.3 ASTM C920-14a, Standard Specification for Elastomeric Joint Sealants.

.4 ASTM C1184-14, Standard Specification for Structural Silicone Sealants.

.5 ASTM C1311-14, Standard Specification for Solvent Release Sealants.

.6 ASTM E814-13a, Standard Test Method for Fire Tests of Penetration Firestop Systems.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 19.13-M87, Sealing Compound, One-component, Elastomeric, Chemical Curing.

.2 CGSB 19-GP-14M-1984, Sealing Compound, One Component, Butyl-Polyisobutylene Polymer Base, Solvent Curing.

.3 CAN/CGSB 19.17-M90, One-Component Acrylic Emulsion Base Sealing Compound.

.4 CAN/CGSB 19.21-M87, Sealing and Bedding Compound, Acoustical.

.5 CAN/CGSB 19.24-M90, Multi-component, Chemical Curing Sealing Compound

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for joint sealants. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Manufacturer's product to describe:

.1 Caulking compound.

.2 Primers.

.3 Sealing compound, each type, including

compatibility when different sealants are in contact with each other.

.2 Samples:

.1 Submit duplicate samples of each type of material and colour.

.2 Cured samples of exposed sealants for each colour where required to match adjacent material.

.3 Manufacturer's Instructions:

.1 Submit instructions to include installation instructions for each product used.

1.4 Quality Assurance

.1 Compatibility: Verify sealants used are compatible with their respective joint substrates.

.2 Provide sealants with appropriate expansion and contraction properties for the joints being sealed.

1.5 Environmental Requirements

.1 Ventilate area of work as directed by Departmental Representative.

PART 2 PRODUCTS

2.1 Sealant Materials

.1 Do not use caulking that emits strong odours, contains toxic chemicals or is not certified as mould resistant in air handling units.

.2 When low toxicity caulks are not possible, confine usage to areas that off gas to exterior, are contained behind air barriers, or are applied several months before occupancy to maximize off gas time.

.3 Where sealants are qualified with primers, use only indicated primers.

2.2 Sealant Materials

.1 Polyurethane Sealant: To CAN/CGSB 19.24, Type 2, Class B; and ASTM C920, Type M, Grade NS, Use NT, M, A and O; non-sag, multi component, chemical curing.

.1 Typical uses: Control joints in concrete floors (when no hard finish is specified), exterior joints, precast concrete panels, expansion joints, curtain walls, panel walls,

perimeter windows.

.2 Elastomeric Polyurethane Sealant: To CAN/CGSB 19.13, Type 2; and ASTM C920, Type S, Grade NS, Use NT, M, A and O; non-sag, single component, moisture curing hybrid polyurethane.

.1 Typical uses: Expansion and control joints, pre-cast concrete panel joints, perimeter caulking of windows and doors, curtain wall joints.

.3 Latex Sealant: To CAN/CGSB 19.17; and ASTM C834; single component, acrylic latex or siliconized acrylic latex.

.1 Typical uses: General purpose, acoustic sealing, back bedding glazing compound, window frame perimeters.

.4 Acoustic Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.

.1 Typical uses: Acoustic sealing of gypsum wall board partitions and curtainwalls, sealing of interior polyethylene air/vapour barrier.

.5 Acoustic and Smoke Sealant: To CAN/CGSB 19.21 and ASTM C919, acoustic grade, single component, non-hardening, non-skinning.

.1 Typical use: Acoustic and smoke sealing of gypsum wall board partitions.

.6 Fire-Resistive Sealant: To ASTM E814, one part fire-stopping sealant.

.1 Typical uses: Penetrations in fire-rated floor and wall assemblies.

.7 Silicone, one part: To CAN/CGSB 19.13; and ASTM C920, Type S, Grade NS; mildew resistant, single component, colour white unless otherwise specified.

.1 Typical uses: Around washroom fixtures, lavatories, janitor's sinks, and other wet areas.

.8 Structural Silicone Sealant: To ASTM C1184, Type M Grade NS, Class 25, Use NT, G and A; multi-component, high modulus

structural sealant.

.1 Typical uses: Structural glazing and curtainwalls.

.9 Butyl: To CGSB 19-GP-14M and ASTM C1311.

.1 Typical uses: Curtainwall joints, gutter and flashing sealing, roof vents, metal panel joining, between base plates and slabs, bedding thresholds, secondary glazing seals.

.10 Preformed compressible and non-compressible back-up materials:

.1 Polyethylene, urethane, neoprene or vinyl foam:

.1 Extruded closed cell foam backer rod.

.2 Size: oversize 30 to 50%.

.2 Neoprene or butyl rubber:

.1 Round solid rod, Shore A hardness 70.

.3 High density foam:

.1 Extruded closed cell polyvinyl chloride (PVC), extruded polyethylene, closed cell, Shore A hardness 20, tensile strength 140 to 200 kPa, extruded polyolefin foam, 32 kg/m3 density, or neoprene foam backer, size as recommended by manufacturer.

.4 Bond breaker tape:

.1 Polyethylene bond breaker tape that will not bond to sealant.

.11 Primer: As recommended by sealant manufacturer, where required, for adhesion of sealant to substrate.

2.3 Joint Cleaner

.1 Non-corrosive and non-staining type, compatible with joint forming materials and sealant in accordance with sealant manufacturer's written recommendations.

.2 Primer: In accordance with sealant manufacturer's written recommendations.

2.4 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Replace defective or damaged materials with new.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for joint sealant installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Site Conditions

.1 Ambient Conditions:

.1 Proceed with installation of joint sealants only when:

.1 Ambient and substrate temperature conditions are within limits permitted by joint sealant manufacturer.

.2 Joint substrates are dry.

.3 Conform to manufacturer's recommended temperatures, relative humidity, and substrate moisture content for application and curing of sealants including special conditions governing use.

.2 Joint-Width Conditions:

.1 Proceed with installation of joint sealants only where joint widths are more than those allowed by joint sealant manufacturer for applications indicated.

.3 Joint-Substrate Conditions:

.1 Proceed with installation of joint sealants only after contaminants capable of interfering with adhesion are removed from joint substrates.

3.3 Surface Preparation

.1 Examine joint sizes and conditions to establish correct depth to width relationship for installation of backup materials and sealants.

.2 Clean bonding joint surfaces of harmful matter substances including dust, rust, oil grease, and other matter that may impair Work.

.3 Do not apply sealants to joint surfaces treated with sealer, curing compound, water repellent, or other coatings unless tests have been performed to ensure compatibility of materials. Remove coatings as required.

.4 Ensure joint surfaces are dry and frost free.

.5 Prepare surfaces in accordance with manufacturer's directions.

3.4 Priming

.1 Where necessary to prevent staining, mask adjacent surfaces prior to priming and caulking.

.2 Prime joint substrates as recommended by sealant manufacturer immediately prior to caulking.

3.5 Backup Material

.1 Apply bond breaker tape where required to manufacturer's instructions.

.2 Install joint filler to achieve correct joint depth and shape, with approximately 30% compression.

3.6 Mixing

.1 Mix materials in accordance with sealant manufacturer's instructions.

3.7 Application

.1 Sealant:

.1 Mask edges of joint where irregular surface or sensitive joint border exists, to provide neat joint.
.2 Apply sealant in continuous beads.
.3 Apply sealant using gun with proper size nozzle.
.4 Use sufficient pressure to fill voids and joints solid.
.5 Form surface of sealant with full bead, smooth, free from ridges, wrinkles, sags, air pockets, embedded impurities.

.6 Tool exposed surfaces before skinning begins to give slightly concave shape.

.7 Remove excess compound promptly as work progresses and upon completion.

.2 Curing:

.1 Cure sealants in accordance with sealant manufacturer's instructions.

.2 Do not cover up sealants until proper curing has taken place

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International (ASTM)

.1 ASTM A653/A653M-13, Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

.2 ASTM E330/E330M-14, Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 1.181-99, Ready-Mixed Organic Zinc-Rich Coating.

.2 CAN/CGSB 12.1-M90, Tempered or Laminated Safety Glass.

.3 CAN/CGSB 12.11-M90, Wired Safety Glass.

.4 CGSB 41-GP-19Ma-84, Rigid Vinyl Extrusions for Windows and Doors.

.3 Canadian Standards Association (CSA)

.1 CSA G40.20-13/G40.21-13, General Requirements for Rolled or Welded Structural Quality Steel/Structural Quality Steel.

.2 CSA W59-13, Welded Steel Construction (Metal Arc Welding).

.4 Canadian Steel Door Manufacturers' Association (CSDMA)

.1 CSDMA, Recommended Specifications for Commercial Steel Doors and Frame Products, 2006.

.2 CSDMA, Recommended Selection and Usage Guide for Commercial Steel Door and Frame Products, 2009.

.5 National Fire Protection Association (NFPA)

.1 NFPA 80-13, Standard for Fire Doors and Other Opening Protectives.

.2 NFPA 252-12, Fire Tests of Door Assemblies.

.6 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S104-10, Standard Method for Fire Tests of Door Assemblies.

.2 CAN/ULC S105-09, Standard Specification for Fire Door

Frames Meeting the Performance Required by CAN/ULC S104.

.3 CAN/ULC S701-11, Standard for Thermal Insulation, Polystyrene, Boards and Pipe Covering.

.4 CAN/ULC S702-14, Standard for Thermal Insulation, Mineral Fibre, for Buildings.

.5 CAN/ULC S704-11, Standard for Thermal Insulation, Polyurethane and Polyisocyanurate Boards, Faced.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

1.3 System Description

.1 Design Requirements:

.1 Design exterior frame assembly to accommodate to expansion and contraction when subjected to minimum and maximum surface temperature of -45°C to 30°C.

.2 Maximum deflection for exterior steel entrance screens under wind load of 1.2 kPa not to exceed 1/175th of span.

.3 Steel fire rated doors and frames: labelled and listed by an organization accredited by Standards Council of Canada in conformance with CAN/ULC S104 or NFPA 252 for ratings specified or indicated.

.4 Provide fire labelled frames for openings requiring fire protection ratings. Test products in conformance with CAN/ULC S104 or NFPA 252 and listed by nationally recognized agency having factory inspection services.

.5 Insulated exterior doors to minimum R 5.

1.4 Submittals

.1 Product data:

.1 Submit manufacturer's printed product literature, specifications, and datasheets. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Shop drawings:

.1 Submit drawings stamped and signed by professional engineer registered or licensed in British Columbia,

Canada.

.2 Indicate each type of door, material, steel core thicknesses, mortises, reinforcements, location of exposed fasteners, openings, arrangement of hardware, fire rating and finishes.

.3 Indicate each type frame material, core thickness, reinforcements, glazing stops, location of anchors and exposed fastenings, reinforcing, fire rating, and finishes.

.4 Include schedule identifying each unit, with door marks and numbers relating to numbering on drawings and door schedule.

.3 Samples:

.1 Submit one 250 x 250 mm corner sample of each type of frame.

.2 Show butt cut-out.

PART 2 PRODUCTS

2.1 Materials

.1 Hot dipped galvanized steel sheet: To ASTM A653M, ZF75, minimum base steel thickness in accordance with CSDMA Table 1 - Thickness for Component Parts.

.2 Reinforcement: To CSA G40.20/G40.21, Type 44W, coating designation to ASTM A653M, ZF75

2.2 Dore Core Materials

.1 Honeycomb construction:

.1 Structural small cell, 24.5 mm maximum kraft paper 'honeycomb', weight: 36.3 kg per ream minimum, density: 16.5 kg/m3 minimum, sanded to required thickness.

.2 Stiffened: Face sheets welded.

.1 Fibreglass: to CAN/ULC S702, semi-rigid, density 24 kg/m3.

.2 Expanded polystyrene: CAN/ULC S701, density 16 to 32 kg/m3.

.3 Polyurethane: To CAN/ULC S704 rigid, modified polyisocyanurate, closed cell board. Density 32 kg/m3.

.3 Temperature rise rated (TRR): Core composition to limit temperature rise on unexposed side of door to 250°C for time required by building code. Core to be tested as part of a complete door assembly, in accordance with CAN/ULC S104 or NFPA 252, covering Standard Method of Tests of Door Assemblies and listed by nationally recognized testing agency having factory inspection service.

2.3 Glazing

.1 Safety Wired Glass: CAN/CGSB-12.1; CAN/CGSB 12.11, Type 1-polished both sides (transparent), safety wire glass; 13 mm grid size; minimum 6 mm thick.

.1 For typical vision glass application.

.2 Safety Glass: To CAN/CGSB 12.1, Class B, clear tempered, 6 mm thick.

.1 For typical interior sidelights.

.3 Glazing film:

.1 Self-adhering polyester film, abrasion resistant, thickness minimum 0.15 mm. Pattern and opacity as selected by Owner from manufacturer's standard range.

2.4 Adhesives

.1 Honeycomb cores and steel components: heat resistant, spray grade, resin reinforced neoprene/rubber (polychloroprene)

			based, low viscosity, contact cement.
		.2	Polystyrene and polyurethane cores: Heat resistant, epoxy resin based, low viscosity, contact cement.
		.3	Lock-seam doors: Fire resistant, resin reinforced polychloroprene, high viscosity, sealant/adhesive.
2.5	Primer	.1	Touch-up primer to CAN/CGSB 1.181.
2.6	Accessories	.1	Glazing Stops: Formed galvanized steel channel, minimum 16 mm high, accurately fitted, butted at corners and fastened to frame sections with counter-sunk tamper proof sheet metal screws.
		.2	Door silencers: Single stud rubber/neoprene type.
		.3	Exterior top caps: Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
		.4	Metallic paste filler: To manufacturer's standard.
		.5	Fire labels: Metal riveted.
2.7	Frames Fabrication General	.1	Fabricate frames in accordance with CSDMA specifications.
		.2	Fabricate frames to profiles and maximum face sizes as indicated.
		.3	Exterior frames: 1.6 mm welded thermally broken type construction.
		.4	Interior frames: 1.6 mm welded type construction.
		.5	Blank, reinforce, drill and tap frames for mortised, templated hardware, electronic hardware using templates provided by finish hardware supplier. Reinforce frames for surface mounted hardware.
		.6	Prepare frame for door silencers, 3 for single door, 2 at head for double door.
		.7	Conceal fastenings except where exposed fastenings are indicated.
		.8	Provide factory-applied touch up primer at areas where zinc coating has been removed during fabrication.
		.9	Insulate exterior frame components.

2.8	Frame Anchorage	.1	Provide appropriate anchorage to floor and wall construction.
		.2	Locate each wall anchor immediately above or below each hinge reinforcement on hinge jamb and directly opposite on strike jamb.
		.3	Provide 2 anchors for rebate opening heights up to 1520 mm and 1 additional anchor for each additional 760 mm of height or fraction thereof.
		.4	Locate anchors for frames in existing openings not more than 150 mm from top and bottom of each jambs and intermediate at 660 mm on centre maximum.
2.9	Frames	.1	Welding in accordance with CSA W59.
		.2	Accurately mitre or mechanically joint frame product and securely weld on inside of profile.
		.3	Cope accurately and securely weld butt joints of mullions, transom bars, centre rails and sills.
		.4	Grind welded joints and corners to a flat plane, fill with metallic paste and sand to uniform smooth finish.
		.5	Securely attach floor anchors to inside of each jamb profile.
		.6	Weld in 2 temporary jamb spreaders per frame to maintain proper alignment during shipment.
2.10	Door Fabrication General	.1	Doors: Swing type, flush, with provision for glass openings as indicated.
		.2	Exterior doors: Hollow steel construction.
		.3	Interior doors: Hollow steel construction.
		.4	Fabricate doors with longitudinal edges locked seamed, welded. Seams: Grind welded joints to a flat plane, fill with automotive body filler and sanded flush.
		.5	Doors: Manufacturer's proprietary construction, engineered and tested as part of a fully operable assembly, including door, frame, gaskets, and hardware.
		.6	Blank, reinforce, drill doors and tap for mortised, templated hardware and electronic hardware.

.7 Factory prepare holes 12.7 mm diameter and larger except mounting and through-bolt holes, on site, at time of hardware installation.

.8 Reinforce doors where required, for surface mounted hardware. Provide flush PVC top caps to exterior doors. Provide inverted, recessed, spot welded channels to top and bottom of interior doors.

.9 Provide factory-applied touch-up primer at areas where zinc coating has been removed during fabrication.

.10 Provide fire labelled doors for those openings requiring fire protection ratings, as scheduled. Test such products in conformance with CAN/ULC S104 or NFPA 252 and list by nationally recognized agency having factory inspection service and construct as detailed in Follow-Up Service Procedures/Factory Inspection Manuals issued by listing agency to individual manufacturers.

2.11 Doors: Honeycomb Core Construction

.1 Form face sheets for exterior doors from 1.6 mm sheet steel with polyurethane core laminated under pressure to face sheets.

.2 Form face sheets for interior doors from 1.6 mm sheet steel with temperature rise rated core laminated under pressure to face sheets.

2.12 Hollow Steel Construction

.1 Form face sheets for exterior doors from 1.6 mm sheet steel.

.2 Form face sheets for interior doors from 1.6 sheet steel.

.3 Reinforce doors with vertical stiffeners, securely welded to face sheets at 150 mm on centre maximum.

.4 Fill voids between stiffeners of exterior doors with polyurethane core.

.5 Fill voids between stiffeners of interior doors with temperature rise rated core.

2.13 Thermally Broken Doors and Frames

.1 Fabricate thermally broken doors by using insulated core and separating exterior parts from interior parts with continuous interlocking thermal break.

		.2	Thermal break: Rigid polyvinylchloride extrusion conforming to CGSB 41-GP-19Ma.
		.3	Fabricate thermally broken frames separating exterior parts form interior parts with continuous interlocking thermal break.
		.4	Apply insulation.
2.14	Delivery, Storage and Handling	.1	Deliver, store and handle materials in accordance with manufacturer's instructions.

PART 3 EXECUTION

3.1	Manufacturer's Instructions	.1	Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.
3.2	Examination	.1	Verify conditions of substrate are acceptable for metal door and frame installation in accordance with manufacturer's written instructions.
		.1	Visually inspect substrate.
		.2	Inform Departmental Representative of unacceptable conditions.
		.3	Proceed with installation only after unacceptable conditions have been remedied.
3.3	Installation General	.1	Install labelled steel fire rated doors and frames to NFPA 80 except where specified otherwise.
		.2	Install doors and frames to CSDMA Installation Guide.
3.4	Frame Installation	.1	Set frames plumb, square, level, and at correct elevation.
		.2	Secure anchorages and connections to adjacent construction.
		.3	Brace frames rigidly in position while building-in. Install temporary horizontal wood spreader at third points of door opening to maintain frame width. Provide vertical support at centre of head for openings over 1200 mm wide. Remove temporary spreaders after frames are built-in.
		.4	Make allowances for deflection of structure to ensure structural loads are not transmitted to frames.

.5 Caulk perimeter of frames between frame and adjacent material.

.6 Maintain continuity of air barrier and vapour retarder.

3.5 Door Installation

.1 Install doors and hardware in accordance with hardware templates and manufacturer's instructions.

.2 Provide even margins between doors and jambs and doors and finished floor and thresholds as follows.

.1 Hinge side: 1.0 mm.

.2 Latchside and head: 1.5 mm.

.3 Finished floor, top of carpet, noncombustible sill, and thresholds: 13 mm.

.3 Adjust operable parts for correct function.

3.6 Finish Repairs

.1 Touch up with primer finishes damaged during installation.

.2 Fill exposed frame anchors and surfaces with imperfections with metallic paste filler and sand to a uniform smooth finish.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 American National Standards Institute (ANSI)

.1 ANSI A156.1-2013, Butts and Hinges.

.2 ANSI A156.2-2011, Bored and Preassembled Locks and Latches.

.3 ANSI A156.3-2014, Exit Devices.

.4 ANSI A156.4-2013, Door Controls - Closers.

.5 ANSI A156.10-2011, Power Operated Pedestrian Doors.

.6 ANSI A156.16-2013, Auxiliary Hardware.

.7 ANSI A156.19-2013, Power Assist and Low Energy Power - Operated Doors.

.2 Canadian Standards Association (CSA)

.1 CSA B651-12, Accessible Design for the Built Environment.

.3 Canadian Steel Door and Frame Manufacturers' Association (CSDMA)

.1 CSDMA Recommended Dimensional Standards for Commercial Steel Doors and Frames - 2009.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Practices

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for door hardware. Include product characteristics, performance criteria, physical size, finish and limitations.

.2 Samples:

.1 Submit for review and acceptance of each unit.

.2 Samples will be returned for inclusion into work.

.3 Identify each sample by label indicating applicable specification paragraph number, brand name and number, finish and hardware package number.

.4 After approval samples will be returned for incorporation in Work.

.3 Hardware Schedule:

.1 Submit a detailed finish hardware schedule prepared by

an architectural hardware consultant.

.2 Indicate specified hardware, including make, model, material, function, size, finish, and other pertinent information.

.4 Test Reports: certified test reports showing compliance with specified performance characteristics and physical properties.

.5 Operation and Maintenance Data: Submit operation and maintenance data for door hardware.

.6 Tools:

.1 Supply 2 sets of wrenches for door closers, locksets, and fire exit hardware.

1.4 Quality Assurance

.1 Regulatory Requirements:

.1 Hardware for doors in fire separations and exit doors certified by a Canadian Certification Organization accredited by Standards Council of Canada.

.2 Certificates: Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

PART 2 PRODUCTS

2.1 Delivery, Storage and Handling

.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original factory packaging, labelled with manufacturer's name and address.

.3 Package items of hardware including fastenings, separately or in like groups of hardware, label each package as to item definition and location.

.4 Storage and Handling Requirements:

.1 Store materials off ground indoors in dry location and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect door hardware from nicks, scratches,

and blemishes.

.3 Protect prefinished surfaces with wrapping or strippable coating.

.4 Replace defective or damaged materials with new.

2.2 Hardware Items

.1 Use one manufacturer's products only for similar items.

.2 Provide hardware meeting CSA B651 for barrier-free design.

2.3 Door Hardware

.1 Deadbolts, locks, latchsets:

.1 To ANSI A156.2 Series 4000 Grade 1, complete with mortised faceplate bolt/latch and cylinders.

.2 Butts and hinges: To ANSI A156.1.

.1 Ball bearing hinges with five knuckles and two sets of bearings.

.2 Use non-ferrous hinges on exterior doors.

.3 Provide non-removable pins for hinge barrels exposed on exterior side.

.3 Exit devices: To ANSI A156.3, Grade 1, and ULC listed for Accident Hazard and Fire Exit.

.4 Door Closers: To ANSI A156.4, Grade 1, and ULC listed.

.1 Meet barrier free requirements and provide maximum degree of opening required.

.2 Opening force 3 kg for interior doors, 5 kg for exterior doors.

.5 Door Operators:

.1 Power-operated pedestrian doors: to ANSI/BHMA A156.10.

.2 Power assist and low energy power operated doors: to ANSI/BHMA A156.19.

.6 Auxiliary hardware: To ANSI A156.16.

.1 Door viewer: Listed or labelled for fire doors, 180 degree viewing area.

.2 Stops: Heavy duty, high quality. Provide solid backing for

door stops.

.1 Wall mounted convex/concave dome stop with concealed mounting.

.2 Floor mounted half dome rubber stop with concealed mounting.

.7 Door bottom seal: Heavy duty, door seal of extruded aluminum frame and hollow closed cell neoprene weather seal, closed ends, clear anodized finish.

.8 Thresholds: Extruded aluminum, mill finish, bevelled, barrier free.

.1 Set on two continuous beads of sealant and secure with minimum 3 corrosion resistant fasteners.

.2 Exterior: Maximum height 13 mm.

.3 Interior: Maximum height 6 mm.

.9 Weatherstripping: Heavy duty bulb type extruded closed cell sponge neoprene/clear anodized finish aluminum weatherstrips.

.1 Air infiltration to be restricted to maximum 0.05m3 per minute per 1.0 metres of joint.

.10 Kickplates: Minimum 250 mm high, full width of door, 1.6 mm thick, aluminum C28 finish or stainless steel C-32D finish, secured with corrosion resistant screws.

.11 Barrier Free Pneumatic Door Operator:

.1 Heavy duty pneumatically assisted door closer, capable of multi-door operation, complete with actuators, control boxes, pneumatic tubing and compressed air source.

.2 Self contained control box/compressor combination for independent operation of two door leaves.

.3 Control boxes: complete with electric strike relay.

.4 Mount operators on either push or pull sides of doors as required to place them inside rooms.

.5 Electrical box and actuator: Hardwired low voltage

actuator with stainless steel 114 mm round plate, engraved blue filled with handicap symbol. Box 51 mm wide x 102 mm high x 50 mm deep single gang electrical box, flush mounted in wall, locations indicated.

.6 Supply switched line voltage to control box. Locate switch adjacent to box.

.7 Supply low voltage wiring to each actuator and 6 mm diameter air tubing to each operator.

2.4 Fastenings

.1 Use only fasteners provided by manufacturer. Failure to comply may void warranties and applicable licensed labels.

.2 Supply screws, bolts, expansion shields and other fastening devices required for satisfactory installation and operation of hardware.

.3 Exposed fastening devices to match finish of hardware.

.4 Where pull is scheduled on one side of door and push plate on other side, supply fastening devices, and install so pull can be secured through door from reverse side. Install push plate to cover fasteners.

.5 Use fasteners compatible with material through which they pass.

2.5 Keying

.1 Determine keying requirements in consultation with Departmental Representative and Owner.

PART 3 EXECUTION

3.1 Installation

.1 Manufacturer's Instructions: Comply with manufacturer's written recommendations, including product technical bulletins, product catalogue installation instructions, product carton installation instructions, and data sheets.

.2 Supply metal door and frame manufacturers with complete instructions and templates for preparation of their work to receive hardware.

.3 Supply manufacturers' instructions for proper installation of each hardware component.

.4 Install hardware to standard hardware location dimensions in

accordance with CSDMA Canadian Metric Guide for Steel Doors and Frames (Modular Construction).

.5 Where door stop contacts door pulls, mount stop to strike bottom of pull.

.6 Use only manufacturer's supplied fasteners.

.1 Use of "quick" type fasteners, unless specifically supplied by manufacturer, is unacceptable.

3.2 Adjusting

.1 Adjust door hardware, operators, closures and controls for optimum, smooth operating condition, safety and for weather tight closure.

.2 Lubricate hardware, operating equipment and other moving parts.

.3 Adjust door hardware to ensure tight fit at contact points with frames.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 ASTM International

.1 ASTM C475/C475-12e1, Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board.

.2 ASTM C645-14, Standard Specification for Nonstructural Steel Framing Members.

.3 ASTM C840-13, Standard Specification for Application and Finishing of Gypsum Board.

.4 ASTM C1002-14, Standard Specification for Steel Self-Piercing Tapping Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs.

.5 ASTM C1178/C1178M-13, Standard Specification for Glass Mat Water-Resistant Gypsum Backing Panel.

.6 ASTM C1325-14, Standard Specification for Non-Asbestos Fiber-Mat Reinforced Cementitious Backer Units.

.7 ASTM C1396/C1396M-14a, Standard Specification for Gypsum Wallboard.

.8 ASTM C1629/C1629M-14a, Standard Classification for Abuse-Resistant Nondecorated Gypsum Panel Products and Fiber-Reinforced Cement Panels.

.9 ASTM D3273-12, Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.

.2 Canadian General Standards Board (CGSB)

.1 CAN/CGSB 51.34-M86 (R1988), Vapour Barrier, Polyethylene Sheet for Use in Building Construction.

.3 Gypsum Association (GA)

.1 GA-214-15, Recommended Levels of Finish for Gypsum Board, Glass Mat, and Fiber-Reinforced Gypsum Panels.

.2 GA-216-13, Application and Finishing of Gypsum Panel Products.

.4 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S101-14, Standard Methods of Fire Endurance Tests of Building Construction and Materials.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 07 26 00 – Vapour Barriers

1.3 System Description/Performance Requirements

.1 Materials: As required to achieve specified performance criteria; functionally compatible with adjacent materials and components, and meeting minimum requirements and relevant standards specified.

.2 Provide physical separation between spaces included in the program, constructed to achieve fire ratings required by code, appropriate security between adjacent spaces, and visual, acoustical, and atmospheric isolation as necessary to maintain desired conditions in each space.

.3 Provide finished interior partitions for spaces required by program that are appropriate for anticipated usage and traffic in each area.

.4 Provide smooth textured partitions at circulation routes.

.5 At spaces used for food preparation, provide smooth, impervious, and water-resistant partition surfaces and integral coved base that allows chemical cleaning and sterilization without damage.

.6 Provide wall protection at areas subject to impact by facility users and equipment.

.7 Install diatomaceous earth for bedbug control in wall voids between living areas, including:

.1 Between stud walls.

.2 Under bath tub installation.

.3 Common plumbing areas.

.4 Under kitchen cupboards and vanities.

1.4 Submittals

.1 Product Data:

.1 Submit manufacturer's instructions, printed product literature and data sheets for gypsum board assemblies, Include product characteristics, performance criteria, physical size, finish and limitations.

1.5 Regulatory Requirements

.1 Conform to applicable code for fire rated as follows:

.1 Fire resistance classifications to CAN/ULC S101.

.2 Fire rated Design Assembly No. as listed on Drawings.

PART 2 PRODUCTS

2.1 Delivery, Storage and Handling

.1 Deliver, store, and handle materials in accordance with manufacturer's written instructions.

.2 Deliver materials to site in original packaging, labelled with manufacturer's name and identification.

.3 Storage and Handling Requirements:

.1 Store gypsum board assemblies materials level off ground and indoors and in accordance with manufacturer's recommendations in clean, dry, well-ventilated area.

.2 Store and protect gypsum board assemblies from nicks, scratches, and blemishes.

.3 Protect from weather, elements and damage from construction operations.

.4 Handle gypsum boards to prevent damage to edges, ends or surfaces.

.5 Replace defective or damaged materials with new.

2.2 Materials

.1 Standard gypsum board: ASTM C1396/C1396M.

.2 Fire resistant gypsum board: ASTM C1396/C1396M, Type X.

.3 Water-resistant gypsum tile backer board: ASTM C1178/C1178M, Type X, water resistant board with enhanced moisture and mould resistant gypsum core, faces bonded to inorganic fibreglass mat wrapping.

.4 Cementitious Backer Board: ASTM C1325, asbestos and formaldehyde free, noncombustible composite board of Portland cement, ground sand, cellulose fibre, thickness and length to suit for ceramic tile shower and tub surrounds.

.5 Glass mat water-resistant gypsum backing board: ASTM C1178/C1178M, Type X, water resistant board with enhanced moisture and mould resistant gypsum core, coated inorganic fibreglass mat facers front and back for use as exterior sheating.

.1 Mould resistance to ASTM D3273: 10.

.6 Abuse-Resistant Gypsum Board: ASTM C1629, Type X for applications requiring protection from damage.

.7 Steel drill screws: ASTM C1002.

.1 Use corrosion resistant screws for fastening cementitious and water-resistant gypsum tile backer board.

.8 Corner beads: Tape-on corners with abrasion resistant finish.

.9 Sealants: In accordance with Section 07 92 00 - Joint Sealants.

.10 Polyethylene: CAN/CGSB 51.34, Type 2.

.11 Joint tape: ASTM C475, 50 mm wide fibre paper tape.

.12 Joint compound: ASTM C475, asbestos-free.

PART 3 EXECUTION

3.1 Examination

.1 Verify conditions of substrate are acceptable for gypsum board installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

3.2 Erection

.1 Apply and finish gypsum board to ASTM C840 or GA-216 except where specified otherwise.

.2 Frame with furring channels, perimeter of openings for access panels, light fixtures, diffusers, grilles.

.3 Install furring channels parallel to, and at exact locations of, steel stud partition header track.

.4 Furr for gypsum board faced vertical bulkheads within and at termination of ceilings.

.5 Furr above suspended ceilings for gypsum board fire and sound stops, and to form plenum areas as indicated.

.6 Install wall furring for gypsum board wall finishes to ASTM C840, except where specified otherwise.

.7 Install furring as required for fire resistance ratings indicated.

.8 Furr openings and around built-in equipment, cabinets, and access panels on four sides. Extend furring into reveals. Check clearances with equipment suppliers.

.9 Furr duct shafts, beams, columns, pipes and exposed services where indicated.

.10 Erect drywall resilient furring transversely across studs, spaced maximum 600 mm on centre and not more than

150 mm from ceiling/wall juncture. Secure to each support with drywall screws.

.11 Install 150 mm continuous strip of 12.7 mm gypsum board along base of partitions where resilient furring installed.

3.3 Application

.1 Apply gypsum board after bucks, anchors, blocking, sound attenuation, electrical work, and mechanical work have been approved.

.2 Apply single layer standard gypsum board in most economical direction, with ends and edges occurring over firm bearing.

.3 Apply gypsum board to furring or framing using screw fasteners. Maximum spacing of screws 300 mm on centre.

.1 Apply gypsum board on ceilings to ASTM C840 prior to application of walls.

.2 Apply gypsum board vertically or horizontally, providing sheet lengths that will minimize end joints.

.4 Install fire rated gypsum board in accordance with applicable ULC design number.

.5 Apply water-resistant gypsum board where wall tiles and tub surrounds are to be applied, adjacent to sinks and janitors closets. Apply water-resistant sealant to edges, ends, cut-outs which expose gypsum core and to fastener heads. Do not apply joint treatment on areas to receive tile finish.

.6 Install gypsum board on walls vertically to avoid end-butt joints. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs, except where local codes or fire-rated assemblies require vertical application.

.7 Install gypsum board with face side out.

.8 Do not install damaged or damp boards.

.9 Locate edge or end joints over supports. Stagger vertical joints over different studs on opposite sides of wall.

3.4 Installation- General

.1 Erect accessories straight, plumb or level, rigid and at proper plane. Use full length pieces where practical. Make joints tight, accurately aligned and rigidly secured. Mitre and fit corners accurately, free from rough edges.

.2 Install insulating strips continuously at edges of gypsum board and casing beads abutting metal window and exterior door frames, to provide thermal break.

.3 Construct control joint set in gypsum board facing and supported independently on both sides of joint.

.4 Provide continuous polyethylene dust barrier behind and across control joints.

.5 Locate control joints at approximate 9 m spacing on long corridor runs.

.1 Place control joints consistent with lines of building spaces as indicated.

.2 Install control joints straight and true.

.6 Construct expansion joints, at building expansion and construction joints. Provide continuous dust barrier.

.1 Install expansion joints straight and true.

.7 Splice corners and intersections together and secure to each member with 3 screws.

.8 Install access doors to electrical and mechanical fixtures as required.

.1 Rigidly secure frames to furring or framing systems.

.9 Finish face panel joints and internal angles with joint system consisting of joint compound, joint tape, and

taping compound installed according to manufacturer's directions and feathered out onto panel faces.

.10 Place corner beads at external corners.

.1 Use longest practical length.

.2 Place edge trim where gypsum board abuts dissimilar materials and as indicated.

.11 Finish gypsum board walls and ceilings to following levels in accordance with GA-214:

.1 Levels of finish:

.1 Concealed areas: Level 1: embed tape for joints and interior angles in joint compound. Surfaces to be free of excess joint compound; tool marks and ridges are acceptable.

.2 For areas to receive spray texture finish: Level 3: embed tape for joints and interior angles in joint compound and apply two separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.3 Areas to receive paint finish: Level 4: embed tape for joints and interior angles in joint compound and apply three separate coats of joint compound over joints, angles, fastener heads and accessories; surfaces smooth and free of tool marks and ridges.

.12 Finish corner beads, control joints and trim as required with two coats of joint compound and one coat of taping compound, feathered out onto panel faces.

.13 Fill screw head depressions with joint and taping compounds to bring flush with adjacent surface of gypsum board so as to be invisible after surface finish is completed.

.14 Sand lightly to remove burred edges and other imperfections. Avoid sanding adjacent surface of board.

.15 Completed installation to be smooth, level or plumb, free from waves and other defects and ready for surface finish.

.16 Treat cut edges and holes in moisture resistant gypsum board with sealant.

.17 Apply one coat of white primer sealer over surface to be textured. When dry apply textured finish in accordance with manufacturer's instructions.

.18 Mix joint compound slightly thinner than for joint taping.

.19 Apply thin coat to entire surface using trowel or drywall broad knife to fill surface texture differences, variations or tool marks.

.20 Allow skim coat to dry completely.

.21 Remove ridges by light sanding or wiping with damp cloth.

3.5 Acoustic Accessories Installation

.1 Install resilient channels at maximum 600 mm on centre. Locate joints over framing members.

.2 Place acoustic insulation in partitions tight within spaces, around cut openings, behind and around electrical and mechanical items within or behind partitions, and tight to items passing through partitions.

.1 Apply 12 mm diameter bead of acoustic sealant continuously around periphery of each face of partitioning to seal gypsum board/structure junction where partitions abut fixed building components. Seal full perimeter of cut-outs around electrical boxes, ducts, in partitions where perimeter sealed with acoustic sealant.

3.6 Ceiling Installation

.1 Install to ASTM C754 or GA-216.

.2 Erect hangers and runner channels for suspended gypsum board ceilings to ASTM C840 except where specified otherwise.

.3 Install ceiling framing independent of walls, columns, and above ceiling work.

.4 Install ceiling boards in direction that will minimize number of end-butt joints. Stagger end joints at least 250 mm.

.5 Support light fixtures by providing additional ceiling suspension hangers within 150 mm of each corner and at maximum 600 mm around perimeter of fixture.

.6 Install work level, to tolerance of 1:1200.

.7 Coordinate location of hangers with other work.

.8 Reinforce openings in ceiling suspension system that interrupt main carrying channels or furring channels, with lateral channel bracing. Extend bracing minimum 600 mm past each end of openings.

.9 Laterally brace entire suspension system.

.10 Locate control joints at changes in substrate construction at approximate 15 m spacing on ceilings.

3.7 Exterior Sheathing Installation

.1 Install components to ASTM C1280 and manufacturer's special instructions.

.2 Coordinate location of openings and through-wall components with other work.

.3 Erect gypsum sheathing with edges butted tight and ends occurring over firm bearing.

.4 Use corrosion resistant screws to fasten gypsum board to furring or framing.

.5 Place gypsum soffit board perpendicular to supports, with staggered end joints over supports.

.6 Treat cut edges and holes in sheathing with sealant.

.7 Place sealable exterior control joints consistent with lines of building spaces to maximum spacing of 9 metres and as indicated on drawings. Form joint with back-to-back casing beads spaced apart to form a flexible sealant joint.

.8 Exterior Soffits and Ceilings: Install exterior gypsum board perpendicular to supports; stagger end joints over supports. Install with 6 mm gap where boards abut other work.

3.8 Tolerances

.1 Maximum variation of finished gypsum board surface from true flatness: 3 mm in 3 m, in any direction.

3.9 Ambient Conditions

.1 Maintain temperature 10°C minimum, 21°C maximum for 48 hours prior to and during application of gypsum boards and joint treatment, and for 48 hours minimum after completion of joint treatment.

.2 Apply board and joint treatment to dry, frost-free surfaces.

.3 Ventilate building spaces as required to remove excess moisture that would prevent drying of joint treatment material immediately after its application.

END OF SECTION

PART 1 GENERAL

1.1 References
.1 ASTM International
.1 ASTM E1155-14/E1155M, Standard Test Method for Determining Floor Flatness and Floor Levelness Numbers.
.2 ASTM F1303-04 (2014), Standard Specification for Sheet Vinyl Floor Covering with Backing.
.3 ASTM F2169-15, Standard Specification for Resilient Stair Treads.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures

1.3 Submittals
.1 Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns and colours available.
.2 Samples:
.1 Submit duplicate 300 x 300 mm sample pieces of sheet material, 300 mm long samples of base.

1.7 Warranty
.1 Sheet vinyl flooring: 25 year manufacturer warranty.
.2 Stair treads: 20 year manufacturer warranty.

PART 2 PRODUCTS

2.1 Delivery, Storage and Handling
.1 Deliver, store and handle materials in accordance with manufacturer's written instructions.

2.2 Ambient Conditions
.1 Maintain air temperature and structural base temperature at flooring installation area above 20°C for 48 hours before, during, and 48 hours after installation.

2.3 Materials
.1 Heterogeneous sheet vinyl: To ASTM F1303, Type 1, Grade 1, Class B.
.1 Binder content: Minimum 90%.
.2 Wear layer:
.1 Suites: Minimum 0.55 mm

.2 Common areas: Minimum 0.70 mm.

.3 Overall thickness: Minimum 2.5 mm.

.4 Maintenance free.

.5 Colour: As selected by Departmental Representative.

.2 Homogeneous sheet vinyl: To ASTM F1913

.1 Binder content: Minimum 50%.

.2 Wear layer minimum thickness: Minimum 2.5 mm.

.3 Overall thickness: Minimum 2.5 mm.

.4 Maintenance free.

.5 Abrasion resistance to EN 660: Group T.

.6 Colour: As selected by Departmental Representative.

.3 Slip resistant sheet vinyl: To ASTM F1303, Type 2, Grade 1, Class A backing; or to ASTM F1913.

.1 Static coefficient To ASTM D2047:

.1 Minimum 0.60 for level surfaces.

.2 Minimum 0.80 for dry ramps.

.4 Rubber sheet flooring:

.1 Prefabricated rubber athletic flooring, calendered and vulcanized with a base of natural and synthetic rubbers, stabilizing agents and pigmentation; manufactured in two (2) layers.

.2 Tensile Strength: ASTM D412; >/= 600psi.

.3 Thickness: 3 mm (0.12 inch).

.5 Stair Treads: ASTM F2169.

.1 Full width and depth of stair tread in one piece with nosing and high visual contrast strip.

.2 Material: Rubber or vinyl.

.3 Design: Slip resistant.

.6 Primers and adhesives: Types recommended by resilient flooring manufacturer for specific material on applicable substrate, above, on or below grade.

.7 Sub-floor filler and leveller: Self-levelling cementitious compound capable of bonding to properly prepared substrate surfaces.

.1 Compressive strength: Minimum 36.5 MPa (5300 psi) at 28 days.

.2 Capable of being walked on without damage after 3 hours.

.3 Capable of being coated after 24 hours at 21°C.

.8 Welding rod: To match flooring being fused.

.9 Metal edge strips:

.1 Aluminum extruded, smooth, polished stainless steel with lip to extend under floor finish, shoulder flush with top of adjacent floor finish.

.10 External corner protectors: Stainless steel, type recommended by flooring manufacturer.

.11 Edging to floor penetrations: Aluminum, type recommended by flooring manufacturer.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and datasheets.

3.2 Examination

.1 Verify conditions of substrate are acceptable for resilient floor installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

.3 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.

.1 Composite flatness (FF): Minimum 36.

.2 Composite levelness (FL): Minimum 20.

3.3 Preparation

.1 Verify conditions of substrate are acceptable for resilient floor installation in accordance with manufacturer's written instructions.

.1 Visually inspect substrate in presence of Departmental Representative.

.2 Inform Departmental Representative of unacceptable conditions.

.3 Proceed with installation only after unacceptable conditions have been remedied.

.2 Ensure concrete floors are clean and dry by using test methods recommended by flooring manufacturer.

.3 Confirm flatness of substrate by measurements taken in accordance with ASTM E1155/E1155M.

.1 Composite flatness (FF): Minimum 36.

.2 Composite levelness (FL): Minimum 20.

3.4 Application: Flooring

.1 Provide high ventilation rate, with maximum outside air, during installation, and for 48 to 72 hours after installation. If possible, vent directly to outside. Do not let contaminated air recirculate through district or whole building air distribution system. Maintain extra ventilation for at least one month following building occupation.

.2 Apply adhesive uniformly using recommended trowel. Do not spread more adhesive than can be covered by flooring before initial set takes place.

.3 Lay flooring with seams parallel to building lines to produce a minimum number of seams. Border widths minimum 1/3 width of full material.

.4 Run sheets in direction of traffic. Double cut sheet joints and continuously heat weld according to manufacturer's printed instructions.

.5 As installation progresses, and after installation roll flooring with minimum 45 kg roller to ensure full adhesion.

.6 Cut flooring around fixed objects.

.7 Continue flooring over areas that will be under built-in furniture.

.8 Continue flooring through areas to receive movable type partitions without interrupting floor pattern.

.9 Terminate flooring at centreline of door in openings where adjacent floor finish or colour is dissimilar.

.10 Install metal edge strips at unprotected or exposed edges where flooring terminates.

3.5 Application: Base

.1 Lay out base to keep number of joints at minimum.

.2 Clean substrate and prime with one coat of adhesive.

.3 Apply adhesive to back of base.

.4 Set base against wall and floor surfaces tightly by using 3 kg hand roller.

.5 Install straight and level to variation of 1:1000.

.6 Scribe and fit to door frames and other obstructions. Use pre-moulded end pieces at flush door frames.

.7 Cope internal corners. Use pre-moulded corner units for right angle external corners. Use formed straight base material for external corners of other angles.

.8 Use toeless type base where floor finish will be carpet, coved type elsewhere.

.9 Install toeless type base before installation of carpet on floors.

.10 Heat weld base in accordance with manufacturer's printed instructions.

3.6 Maintenance

.1 Extra Materials:

.1 Provide 5% of each colour, pattern, and type of flooring material used in project, for maintenance use.

.2 Extra materials one piece and from same production run as installed materials.

.3 Identify each roll of sheet flooring.

.4 Deliver to Departmental Representative, upon completion of the work of this section.

END OF SECTION

PART 1 GENERAL

1.1 References
.1 Master Painters Institute (MPI)
.1 MPI Architectural Painting Specifications Manual.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures

1.3 Quality Assurance
.1 Mock-Ups:
.1 When requested by Departmental Representative or inspection agency, prepare and paint a designated surface, area, room, or item, in proposed colour scheme, showing selected colours, gloss/sheen, textures, and quality of work, to MPI Painting Specification Manual standards, for review.
.2 Mock-up will be used:
.1 To judge workmanship, substrate preparation, operation of equipment, material application and quality of work to MPI Architectural Painting Specification Manual standards.
.3 Locate where directed.
.4 Allow for review of mock-up before proceeding with work.
.5 Reviewed mock-up will demonstrate minimum standard of quality required for this work.
.6 Approved mock-up may remain as part of finished work.

1.4 Scheduling
.1 Submit work schedule for various stages of painting for review. Submit schedule minimum of 48 hours in advance of proposed operations.
.2 Obtain written authorization for changes in work schedule.
.3 Schedule painting operations to prevent disruption of occupants.

1.5 Submittals
.1 Product Data:
.1 Submit product data and instructions for each paint and coating product to be used.
.2 Submit product data for the use and application of paint thinner.
.2 Samples:

.1 Submit full range colour sample chips to indicate where colour availability is restricted.

.2 Submit duplicate 200 x 300 mm sample panels of each paint with specified paint or coating in colours, gloss/sheen and textures required to MPI Architectural Painting Specification Manual standards submitted on following substrate materials:

.1 3 mm plate steel for finishes over metal surfaces.

.2 13 mm birch plywood for finishes over wood surfaces.

.3 50 mm concrete block for finishes over concrete or concrete masonry surfaces.

.4 13 mm gypsum board for finishes over gypsum board and other smooth surfaces.

.5 10 mm siding for finishes over wood surfaces.

.3 Retain reviewed samples on-site to demonstrate acceptable standard of quality for appropriate on-site surface.

.4 Test reports: Submit certified test reports for paint from approved independent testing laboratories, indicating compliance with specifications for specified performance characteristics and physical properties.

.1 Lead, cadmium and chromium: presence of and amounts.

.2 Mercury: presence of and amounts.

.3 Organochlorines and PCBs: presence of and amounts.

.5 Certificates: Submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.

.6 Manufacturer's Instructions:

.1 Submit manufacturer's application instructions.

PART 2 PRODUCTS

2.1 Delivery, Storage and Handling

.1 Packing, Shipping, Handling and Unloading:

.1 Pack, ship, handle and unload materials in accordance with manufacturer's written instructions.

.2 Acceptance at Site:

.1 Identify products and materials with labels indicating:

.1 Manufacturer's name and address.

.2 Type of paint or coating.

.3 Compliance with applicable standard.

.4 Colour number in accordance with established colour schedule.

.3 Remove damaged, opened and rejected materials from site.

.4 Storage and Protection:

.1 Provide and maintain dry, temperature controlled, secure storage.

.2 Store materials and supplies away from heat generating devices.

.3 Store materials and equipment in well-ventilated area with temperature range 7°C to 30°C.

.5 Store temperature sensitive products above minimum temperature as recommended by manufacturer.

.6 Keep areas used for storage, cleaning and preparation clean and orderly. After completion of operations, return areas to clean condition.

.7 Remove paint materials from storage only in quantities required for same day use.

.8 Fire Safety Requirements:

.1 Provide one 9 kg dry chemical fire extinguisher adjacent to storage area.

.2 Store oily rags, waste products, empty containers and materials subject to spontaneous combustion in ULC approved, sealed containers and remove from site on a daily basis.

.3 Handle, store, use and dispose of flammable and combustible materials in accordance with National Fire Code of Canada requirements.

.9 Waste Management and Disposal:

.1 Handle and dispose of hazardous materials in accordance with CEPA, TDGA, Regional and Municipal, regulations.

.2 Ensure emptied containers are sealed and stored safely.

.3 Dispose of unused paint and coating materials at official hazardous material collections site.

.4 Paint, stain and wood preservative finishes and related materials (thinners, and solvents) are regarded as hazardous products and are subject to regulations for disposal. Information on these controls can be obtained from Provincial Ministries of Environment and Regional levels of Government.

.5 Material which cannot be reused must be treated as hazardous waste and disposed of in an appropriate manner.

.6 Place materials defined as hazardous or toxic waste, including used sealant and adhesive tubes and containers, in containers or areas designated for hazardous waste.

.7 To reduce the amount of contaminants entering waterways, sanitary/storm drain systems or into ground follow these procedures:

.1 Retain cleaning water for water-based materials to allow sediments to be filtered out.

.2 Retain cleaners, thinners, solvents and excess paint and place in designated containers and ensure proper disposal.

.3 Return solvent and oil soaked rags used during painting operations for contaminant recovery, proper disposal, or appropriate cleaning and laundering.

.4 Dispose of contaminants in approved legal manner in accordance with hazardous waste regulations.

.5 Empty paint cans are to be dry prior to disposal or recycling (where available).

.8 Where paint recycling is available, collect waste paint by type and provide for delivery to recycling or collection facility.

2.2 Materials

.1 Paint materials listed in the MPI Approved Products List (APL) are acceptable for use on this project.

.2 Provide paint materials for paint systems from single manufacturer.

.3 Only qualified products with E2 "Environmentally Friendly" rating are acceptable for use on this project.

.4 Conform to latest MPl requirements for interior painting work including preparation and priming.

.5 Materials (primers, paints, coatings, varnishes, stains, lacquers, fillers, thinners, solvents, etc.) in accordance with MPI Architectural Painting Specification Manual "Approved Product" listing.

.6 Linseed oil, shellac, and turpentine: Highest quality product from approved manufacturer listed in MPI Architectural Painting Specification Manual, compatible with other coating materials as required.

.7 Provide paint products meeting MPI "Environmentally Friendly" E2 ratings based on VOC (EPA Method 24) content levels.

.8 Use MPI listed materials having minimum E2 rating where indoor air quality (odour) requirements exist.

.9 Paints, coatings, adhesives, solvents, cleaners, lubricants, and other fluids:

.1 Manufactured without compounds that contribute to ozone depletion in the upper atmosphere.

.2 Manufactured without compounds that contribute to smog in the lower atmosphere.

.3 Do not contain methylene chloride, chlorinated hydrocarbons, or toxic metal pigments.

.10 Formulate and manufacture water-borne surface coatings with no aromatic solvents, formaldehyde, halogenated solvents, mercury, lead, cadmium, hexavalent chromium or their compounds.

.11 Flash point: 61.0°C or greater for water-borne surface coatings and recycled waterborne surface coatings.

.12 Ensure manufacture and process of both water-borne surface coatings and recycled water-borne surface coatings does not release:

.1 Matter in undiluted production plant effluent generating 'Biochemical Oxygen Demand' (BOD) in excess of 15 mg/L to natural watercourse or sewage treatment facility lacking secondary treatment.

.2 Total Suspended Solids (TSS) in undiluted production plant effluent in excess of 15 mg/L to natural watercourse or a sewage treatment facility lacking secondary treatment.

.13 Water-borne paints and stains, recycled water-borne surface coatings and water borne varnishes to meet minimum "Environmentally Friendly" E2 rating.

.14 Recycled water-borne surface coatings to contain 50% post-consumer material by volume.

2.3 Colours

.1 Submit proposed Colour Schedule to Departmental Representative for review.

.2 Colour schedule will be based upon selection of five base colours and three accent colours. No more than eight colours will be selected for entire project and no more than three colours will be selected in each area.

.3 Selection of colours from manufacturers full range of colours.

.4 Where specific products are available in restricted range of colours, selection based on limited range.

.5 Second coat in three-coat system to be tinted slightly lighter colour than top coat to show visible difference between coats.

2.4 Mixing and Tiniting

.1 Perform colour tinting operations prior to delivery of paint to site. Obtain written approval from Departmental Representative for tinting of painting materials.

.2 Mix paste, powder or catalyzed paint mixes in accordance with manufacturer's written instructions.

.3 Use and add thinner in accordance with paint manufacturer's recommendations. Do not use kerosene or similar organic solvents to thin water-based paints.

.4 Thin paint for spraying in accordance with paint manufacturer's instructions.

.5 Re-mix paint in containers prior to and during application to ensure break-up of lumps complete dispersion of settled pigment, and colour and gloss uniformity.

2.5 Gloss/Sheen Ratings

.1 Paint gloss is defined as sheen rating of applied paint, in accordance with following values:

	Gloss @ 60 degrees	Sheen @ 85 degrees
Gloss Level 1 - Matte Finish (flat)	Max. 5	Max. 10
Gloss Level 2 - Velvet-Like Finish	Max.10	10 to 35
Gloss Level 3 - Eggshell Finish	10 to 25	10 to 35
Gloss Level 4 - Satin-Like Finish	20 to 35	min. 35
Gloss Level 5 - Traditional Semi-Gloss Finish	35 to 70	
Gloss Level 6 - Traditional Gloss	70 to 85	
Gloss Level 7 - High Gloss Finish	More than 85	

2.6 Exterior Painting Systems

.1 Asphalt surfaces:
- .1 EXT 2.1A – latex zone/traffic marking.

.2 Concrete vertical surfaces:
- .1 EXT 3.1A – latex over alkali resistant primer GL3/GL4 satin.

.3 Cementitious composition board:
- .1 EXT 3.3J - latex over alkali resistant primer GL3/GL4 satin.

.4 Structural and miscellaneous steel:
- .1 EXT 5.1C – water based light industrial coating over alkyd primer, GL5 semigloss.

.5 Galvanized metal:
- .1 EXT 5.3J – water based light industrial coating over water based primer, GL5 semi-gloss.

.6 Dimension lumber – painted:
- .1 EXT 6.2M – latex over latex primer, GL3/GL4 satin.

.7 Dimension lumber – stained:
- .1 EXT 6.2B – latex colour stain, water based.

.8 Dressed lumber – painted:
- .1 EXT 6.3J – water based light industrial over alkyd primer, GL5 semi-gloss.

2.7 Interior Painting Systems

.1 Concrete vertical surfaces:
- .1 INT 3.1C – high performance architectural latex, GL5 semi-gloss.

.2 Concrete horizontal surfaces: floors and stairs:
- .1 INT 3.1A – latex floor enamel, low gloss.

.3 Concrete masonry units: smooth and split face block and brick:
- .1 INT 4.2D – high performance architectural latex.

.4 Structural steel and metal fabrications: columns, beams, joists:

.1 INT 5.1R – high performance architectural latex, GL5 semi-gloss.

.5 Galvanized metal: doors, frames, railings, misc. steel, pipes, overhead decking, and ducts.

.1 INT 5.3M - high performance architectural latex GL5 finish.

.6 Dressed lumber - painted:

.1 INT 6.3A – high performance architectural latex, GL5 semi-gloss.

.7 Dressed lumber – stained:

.1 INT 6.3W – water based varnish, clear (over stain), GL4 satin.

.8 Wood paneling and casework: partitions, panels, shelving, millwork:

.1 INT 6.4S - high performance architectural latex GL5 semi-gloss.

.9 Plaster and gypsum board: gypsum wallboard, drywall, "sheet rock type material", and textured finishes:

.1 INT 9.2B - high performance architectural latex.

.1 Suite bathrooms, kitchens, common laundry, and washroom areas: GL5 semi-gloss.

.2 Other areas not noted above:

.1 Walls: GL3 semi-gloss.

.2 Ceilings: GL1 flat.

PART 3 EXECUTION

3.1 Manufacturer's Instructions

.1 Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 General

.1 Perform preparation and operations for interior painting in accordance with MPI Architectural Painting Specifications Manual except where specified otherwise.

.2 Apply paint materials in accordance with paint manufacturer's written application instructions.

3.3 Examination

.1 Investigate existing substrates for problems related to proper and complete preparation of surfaces to be painted. Report to Departmental Representative damages, defects, unsatisfactory or unfavourable conditions before proceeding with work.

.2 Conduct moisture testing of surfaces to be painted using properly calibrated electronic moisture meter, except test concrete floors for moisture using simple "cover patch test". Do not proceed with work until conditions fall within acceptable range as recommended by manufacturer.

.3 Maximum moisture content as follows:

.1 Stucco, plaster and gypsum board: 12%.

.2 Concrete: 12%.

.3 Clay and Concrete Block/Brick: 12%.

.4 Wood: 15%.

3.4 Preparation

.1 Protection:

.1 Protect items that are permanently attached such as Fire Labels on doors and frames.

.2 Protect factory finished products and equipment.

.3 Protect passers-by in and about the building.

.2 Surface Preparation:

.1 Remove electrical cover plates, light fixtures, surface hardware on doors, bath accessories and other surface mounted equipment, fittings and fastenings prior to undertaking painting operations. Identify and store items in secure location and re-installed after painting is completed.

.2 Move and cover furniture and portable equipment as necessary to carry out painting operations. Replace as painting operations progress.

.3 Place "WET PAINT" signs in occupied areas as painting operations progress. Signs to approval of Departmental Representative.

.3 Clean and prepare surfaces in accordance with MPI Architectural Painting Specification Manual requirements. Refer to MPI Manual in regard to specific requirements and as follows:

.1 Remove dust, dirt, and other surface debris by vacuuming, wiping with dry, clean cloths, or compressed air.

.2 Wash surfaces with a biodegradable detergent and clean warm water using a stiff bristle brush to remove dirt, oil and other surface contaminants.

.3 Rinse scrubbed surfaces with clean water until foreign matter is flushed from surface.

.4 Allow surfaces to drain completely and allow to dry thoroughly.

.5 Prepare surfaces for water-based painting, water-based cleaners should be used in place of organic solvents.

.6 Use trigger operated spray nozzles for water hoses.

.7 Many water-based paints cannot be removed with water once dried. Minimize use of mineral spirits or organic solvents to clean up water-based paints.

.4 Prevent contamination of cleaned surfaces by salts, acids, alkalis, other corrosive chemicals, grease, oil and solvents before prime coat is applied and between applications of remaining coats. Apply primer, paint, or pre-treatment as soon as possible after cleaning and before deterioration occurs.

.5 Where possible, prime non-exposed surfaces of new wood surfaces before installation. Use same primers as specified for exposed surfaces.

.1 Apply vinyl sealer to MPI #36 over knots, pitch, sap and resinous areas.

.2 Apply wood filler to nail holes and cracks.

.3 Tint filler to match stains for stained woodwork.

.6 Sand and dust between coats as required to provide adequate adhesion for next coat and to remove defects visible from a distance up to 1000 mm.

.7 Clean metal surfaces to be painted by removing rust, loose mill scale, welding slag, dirt, oil, grease and other foreign substances in accordance with MPI requirements. Remove traces of blast products from surfaces, pockets and corners to be painted.

.8 Touch up of shop primers with primer as specified.

.9 Do not apply paint until prepared surfaces have been accepted by Departmental Representative.

3.5 Application

.1 Method of application to be as approved by Departmental Representative. Conform to manufacturer's application instructions unless specified otherwise.

.2 Brush and Roller Application:

.1 Apply paint in uniform layer using brush and/or roller type suitable for application.

.2 Work paint into cracks, crevices and corners.

.3 Paint surfaces and corners not accessible to brush using spray, daubers and/or sheepskins. Paint surfaces and corners not accessible to roller using brush, daubers or sheepskins.

.4 Brush and/or roll out runs and sags, and over-lap marks. Rolled surfaces free of roller tracking and heavy stipple.

.5 Remove runs, sags and brush marks from finished work and repaint.

.3 Spray application:

.1 Provide and maintain equipment that is suitable for intended purpose, capable of atomizing paint to be applied, and equipped with suitable pressure regulators and gauges.

.2 Keep paint ingredients properly mixed in containers during paint application either by continuous mechanical agitation or by intermittent agitation as frequently as necessary.

.3 Apply paint in uniform layer, with overlapping at edges of spray pattern. Back roll first coat application.

.4 Brush out immediately all runs and sags.

.5 Use brushes and rollers to work paint into cracks, crevices and places that are not adequately painted by spray.

.4 Use dipping, sheepskins or daubers only when no other method is practical in places of difficult access.

.5 Apply coats of paint continuous film of uniform thickness. Repaint thin spots or bare areas before next coat of paint is applied.

.6 Allow surfaces to dry and properly cure after cleaning and between subsequent coats for minimum time period as recommended by manufacturer.

.7 Sand and dust between coats to remove visible defects.

.8 Finish surfaces both above and below sight lines as specified for surrounding surfaces, including such surfaces as tops of interior cupboards and cabinets and projecting ledges.

.9 Finish closets and alcoves as specified for adjoining rooms.

.10 Finish top, bottom, edges and cut-outs of doors after fitting as specified for door surfaces.

3.6 Mechanical/ Electrical Equipment

.1 Paint exposed conduits, pipes, hangers, ductwork, and other mechanical/electrical equipment with colour and texture to match adjacent surfaces. Coordinate with mechanical trades applying banding and labeling after pipes have been painted.

.2 Paint gas piping standard yellow where visible in service spaces.

.3 Paint surfaces inside of ductwork where visible behind louvres, grilles, and diffusers beyond sight line with primer and one coat of mat black, non-reflecting paint.

.4 Paint insides of light valences white.

3.7 Site Tolerances

.1 Walls: No defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: No defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

3.8 Field Quality Control

.1 Interior painting and decorating work shall be inspected by the Departmental Representative acceptable to the specifying authority and local Painting Contractor's Association. Painting contractor shall notify the Departmental Representative a minimum of one week prior to commencement of work and provide a copy of project painting specification, plans and elevation drawings (including pertinent details) as well as a Finish Schedule.

.2 Interior surfaces requiring painting shall be inspected by the Departmental Representative who shall notify the General Contractor in writing of defects or problems, prior to commencing painting work, or after prime coat shows defects in substrate.

.3 Where "special" painting, coating or decorating system applications (i.e. elastomeric coatings) or non-MPI listed products or systems are to be used, paint or coating manufacturer shall provide as part of this work, certification of surfaces and conditions for specific paint or coating system application as well as on site supervision, inspection and approval of their paint or coating system application as required at no additional cost.

.4 Standard of Acceptance:

.1 Walls: no defects visible from a distance of 1000 mm at 90 degrees to surface.

.2 Ceilings: no defects visible from floor at 45 degrees to surface when viewed using final lighting source.

.3 Final coat to exhibit uniformity of colour and uniformity of sheen across full surface area.

.5 Field inspection of painting operations to be carried out by independent inspection firm.

.6 Advise Departmental Representative when surfaces and applied coating is ready for inspection. Do not proceed with subsequent coats until previous coat has been approved.

.7 Cooperate with inspection firm and provide access to areas of work.

.8 Retain purchase orders, invoices and other documents to prove conformance with noted MPI requirements when requested by Departmental Representative.

3.9 Maintenance

.1 Extra Materials

.1 Deliver to extra materials from same production run as products installed. Package products with protective covering and identify with descriptive labels.

.2 Quantity: Provide each type and colour of primer and finish coating in quantities requested by Departmental Representative. Identify colour and paint type in relation to established colour schedule and finish system.

.3 Delivery, storage, and protection: Comply with Departmental Representative requirements for delivery and storage of extra materials.

3.10 Site Conditions

.1 Heating, Ventilation and Lighting:

.1 Provide heating facilities to maintain ambient air and substrate temperatures above 10°C for 24 hours before, during and after paint application until paint has cured sufficiently.

.2 Provide continuous ventilation for seven days after completion of application of paint.

.3 Coordinate use of existing ventilation system with Departmental Representative and ensure its operation during and after application of paint as required.

.4 Provide temporary ventilating and heating equipment where permanent facilities are not available or supplemental ventilating and heating equipment if ventilation and heating from existing system is inadequate to meet minimum requirements.

.5 Provide minimum lighting level of 323 Lux on surfaces to be painted.

.2 Temperature, Humidity and Substrate Moisture Content Levels:

.1 Unless pre-approved written approval by Paint Inspection Agency Authority and product manufacturer, perform no painting when:

.1 Ambient air and substrate temperatures are below 10°C.

.2 Substrate temperature is above 32°C unless paint is specifically formulated for application at high temperatures.

.3 Substrate and ambient air temperatures are not expected to fall within MPI or paint manufacturer's prescribed limits.

.4 The relative humidity is under 85% or when the dew point is more than 3°C variance between the air/surface temperature. Paint should not be applied if the dew point is less than 3°C below the ambient or surface temperature. Use sling psychrometer to establish the relative humidity before beginning paint work.

.5 Rain or snow are forecast to occur before paint has thoroughly cured or when it is foggy, misty, raining or snowing at site.

.6 Ensure that conditions are within specified limits during drying or curing process, until newly applied coating can itself withstand 'normal' adverse environmental factors.

.2 Perform painting work when maximum moisture content of the substrate is below:

.1 Allow new concrete and masonry to cure minimum of 28 days.

.2 15% for wood.

.3 12% for plaster and gypsum board.

.3 Test for moisture using calibrated electronic Moisture Meter. Test concrete floors for moisture using "cover patch test".

.4 Test concrete, masonry and plaster surfaces for alkalinity as required.

.3 Surface and Environmental Conditions:

.1 Apply paint finish in areas where dust is no longer being generated by related construction operations or when wind or ventilation conditions are such that airborne particles will not affect quality of finished surface.

.2 Apply paint to adequately prepared surfaces and to surfaces within moisture limits.

.3 Apply paint when previous coat of paint is dry or adequately cured.

.4 Additional interior application requirements:

.1 Apply paint finishes when temperature at location of installation can be satisfactorily maintained within manufacturer's recommendations.

.2 Apply paint in occupied facilities during silent hours only. Schedule operations to approval of Departmental Representative such that painted surfaces will have dried and cured sufficiently before occupants are affected.

3.11 Restoration

.1 Clean and re-install hardware items removed before undertaken painting operations.

.2 Remove protective coverings and warning signs as soon as practical after operations cease.

.3 Remove paint splashings on exposed surfaces that were not painted. Remove smears and spatter immediately as operations progress, using compatible solvent.

.4 Protect freshly completed surfaces from paint droppings and dust. Avoid scuffing newly applied paint.

.5 Restore areas used for storage, cleaning, mixing and handling of paint to clean condition.

END OF SECTION

PART 1 GENERAL

1.1 References

.1 National Fire Protection Association (NFPA)

.1 NFPA 10 - Portable Fire Extinguishers, 2013 Edition.

.2 Underwriters' Laboratories of Canada (ULC)

.1 CAN/ULC S503-05 (R2010) – Standard for Carbon Dioxide Fire Extinguishers.

.2 CAN/ULC S504-12 - Dry Chemical Fire Extinguishers.

.3 CAN/ULC S508-02 (R2013) - Rating and Fire Testing of Fire Extinguishers.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

1.3 Submittals

.1 Product Data:

.1 Submit manufacturer's printed product literature and datasheet. Include product characteristics, performance criteria, physical size, finish, and limitations.

.2 Shop Drawings: Indicate cabinet physical dimensions, rough-in measurements for recessed cabinets, wall bracket mounted measurements, and location.

.3 Manufacturer's Instructions: Submit manufacturer's installation instructions and special handling criteria, installation sequence, and cleaning procedures.

.4 Manufacturer's Certificate: Certify that Products meet or exceed specified requirements.

1.4 Regulatory Requirements

.1 Conform to National Building Code and NFPA 10 for requirements for extinguishers.

PART 2 PRODUCTS

2.1 Multi-Purpose Dry-Canister Extinguishers

.1 Stored pressure rechargeable type with hose and shut-off nozzle, ULC labelled. Stainless steel tank.

.1 ABC Type: To CAN/ULC S504, complete with pressure gauge.

.2 CO2 type: To CAN/ULC S503.

2.2	Cabinets	.1	Recessed type, formed sheet steel, 1.6 mm thick with flat trim, 180 degrees opening door of 2.5 mm thick steel with latching device.
		.2	Cabinet to maintain fire resistive rating of construction in which installed.
		.3	Door Glazing: Plastic, clear, 3 mm polycarbonate.
2.3	Identification	.1	Identify extinguishers in accordance with recommendations of NFPA 10 and CAN/ULC S508.
		.2	Attach tag or label to extinguishers, indicating month and year of installation. Provide space for service dates.

PART 3 EXECUTION

3.1	Manufacturer`s Instructions	.1	Comply with manufacturer's written recommendations, including product technical bulletins, handling, storage and installation instructions, and datasheets.
3.2	Examination	.1	Verify conditions of substrate are acceptable for cementitious panel installation in accordance with manufacturer's written instructions.
			.1 Visually inspect substrate in presence of Departmental Representative.
			.2 Inform Departmental Representative of unacceptable conditions.
			.3 Proceed with installation only after unacceptable conditions have been remedied.
3.3	Installation	.1	Install or mount extinguishers in cabinets or on brackets as indicated, in accordance with NFPA 10 and manufacturer’s instructions.
		.2	Install cabinets plumb and level in wall openings, location as shown on drawings.
		.3	Secure rigidly in place to walls.

.4 Position cabinet signage at locations acceptable to authority having jurisdiction.

END OF SECTION

PART 1 GENERAL

1.1	Scope	.1	Supply and install two complete (2) UV systems (one duty/one standby) in the water treatment plant building to provide primary disinfection of drinking water.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures
		.2	Section 01 78 00 – Closeout Submittals
		.3	Section 01 79 00 – Demonstration and Training
		.4	Section 01 91 00 – General Commissioning Requirements
		.5	Section 01 91 01 – Equipment and System Performance and Operational Testing
		.6	Section 11 09 25 – Analytical Monitoring
		.7	Section 22 05 00.01 – Mechanical General Requirements
		.8	Section 22 11 16.01 – Piping Systems
		.9	Section 22 42 01.03 – Anchor Bolts
1.3	References	.1	National Building Code 2015 and BC Building Code 2012, follow whichever is more stringent.
		.2	DVGW 294
		.3	Guidelines for Canadian Drinking Water Quality, latest ed.
1.4	Submittals	.1	Submit engineering drawings for review, including:

.1 Shop drawings showing detailed equipment types, datasheets, arrangement, dimensions, process and electrical schematics, piping details and connections, and microprocessor controller details.

.2 Control narrative.

.3 Operations and maintenance manuals, including recommended spare parts list and maintenance schedule.

.4 Number of hours of zero flow before system shut-down, maximum recommended number of start-ups from shut-down per day per reactor, reactor warm-up time from shut-down.

.2 Submit documentation confirming validation by a qualified third party of the proposed UV units for drinking water use. The validation report will confirm:

.1 Performance in accordance with DVGW 294 validation protocols.

.2 UV dose at end of lamp life, with fouled sleeves: provide a minimum dose of 40 mJ/cm^2 in accordance with the DVGW 294 validation protocol.

.3 The DVGW 294 validation testing shall include the UV sensors and automatic mechanical cleaning system.

.4 Provide a validation certificate and UV dose curves to demonstrate that the UV Manufacturer has obtained third party validation that covers the full range of design and operating conditions (flow rate and UVT). Extrapolations to design flow rates, UV transmittance values, or UV doses outside the range actually tested, is not permitted.

.3 Submit pressure test report from the manufacturer certifying the reactor was tested and watertight to a minimum test pressure of 1,034 kPa.

.4 Submit a description of manufacturer's service capabilities including local support offered for technical service, spare parts, and return of spent lamp bulbs.

.5 Submit evidence of previous successful performance utilizing the UV system in similar applications. The proposed manufacturer must be able to demonstrate at least ten (10) permanent installations of this equipment type.

.6 Submit a statement by the equipment manufacturer listing any deviations or exceptions taken to these specifications.

.7 Provide warranty documentation for UV lamps and ballasts. The UV lamp shall be warranted for a minimum of 12,000 hours of operation, prorated at 9,000. Ballasts shall be warranted for a minimum of 43,830 hours, prorated after 8,760 hours.

1.5 Closeout Submittals

.1 Provide operation and maintenance data as specified in Section 01 78 00 – Closeout Submittals.

PART 2 PRODUCTS

2.1 Components

.1 Provide two (2) complete low pressure ultraviolet (UV) disinfection systems, complete with all control equipment and accessories as specified within this Section.

.1 The reactors and control panels shall be wall-mounted and shall fit within the piping footprint as shown on Sheets M100 and M101 of the Contract Drawings, and allow for reactor service clearance (i.e. for changing out UV lamps).

.2 Features:

.1 Equipment Redundancy: 100%. Provide two UV systems (one duty, one standby). Each UV system is to have its own microprocessor controller and electrical supply and be capable of operating independently of the other UV system.

.2 Each system utilizes active control based on the following dose parameters:

.1 UV lamp intensity, and

.2 Water flow rate.

.3 The UV equipment disinfects water with the following characteristics:

.1 Flow Range (per UV reactor) is 0 L/s to 4.0 L/s (Peak Design Flow: 4.0 L/s).

.2 Expected Water Temperature Range: 0.5ºC to 10ºC.

.3 Design % Ultraviolet Transmittance @ 253.7 nm (%UVT): 90%.

.4 Hardness: 35 mg/L as CaCO3.

.5 Iron: 0.02 mg/L.

.6 Manganese: 0.0091 mg/L.

.7 Turbidity: <5 NTU.

.8 Source water: Groundwater wells.

.4 Expected operating pressure of the UV system is 414 kPa. Reactors shall be tested by supplier to 1,034 kPa for a minimum of 10 minutes.

.5 Each UV system shall:

.1 Deliver a minimum UV dose of 40 mJ/cm2 under the peak design flow rate and the design UVT.

.2 Operate in an enclosed reactor vessel and use low pressure high output UV lamps.

.3 Come complete with UV reactor, UV intensity sensor(s), automatic mechanical cleaning system, and Control Panel containing the electronic ballasts, UV microprocessor and Operator Interface, as herein specified.

.4 Be equipped with an automatic mechanical cleaning system tested in the validation report. The system is to continue disinfection while the automatic cleaning system is in operation.

.5 Continue providing disinfection while the UV intensity sensor calibration is being checked.

.6 Allow for complete system shutdown.

.7 Not require draining the UV reactors in order to change the UV lamps.

.8 Have Type 316L stainless steel UV reactor and all metal components in contact with the feed water.

.9 Be furnished with the latest components and equipment available at the time of shipment.

.10 Be supplied pre-assembled and ready for installation.

.3 Provide UV Reactors that:

.1 Have three (3) ports fixed to its outer wall to allow reactor draining and cleaning.

.2 Accept their respective UV lamps and quartz sleeves through only one end of the vessel. This end of the UV reactor shall allow for complete reactor entry so internal inspection and/or service can be accomplished.

.3 Are able to be operated at a maximum inlet pressure of 1,034 kPa.

.4 Indicate lamp position within the reactor using a numbering system fixed to the lamp wiring at the service end of the UV reactor.

.5 Have all wetted components within the reactor NSF 61 certified.

.4 UV Lamps:

.1 Low pressure high output (LPHO) amalgam type.

.2 Significantly rugged filament to withstand shock and vibration.

.3 Have a lamp base design that which prevents arcing between electrical pins.

.4 Lamp bases to be resistant to UV light and ozone.

.5 All electrical connections to the UV lamps will be terminated at one end.

.6 Have monochromatic spectral output peaking at 254 nanometers

.5 Lamp End Seals and Lamp Holder:

.1 The open end of the UV lamp sleeves will be sealed to the sleeve guide by a suitable compression o-ring.

.2 The o-ring compression is made by a sleeve nut that will require no special tools for installation or removal.

.3 Each UV lamp electrical connection will incorporate a sealing boot, which is held firmly in place by the sleeve nut to prevent emission of ultraviolet rays.

.6 UV Lamp Sleeves

.1 UV lamp sleeves will be manufactured from clear fused Type 214 quartz with a minimum UV transmissivity of 89 percent.

.2 The UV lamp sleeves shall be accessible through the chamber service entrance.

.7 Automatic Cleaning System:

.1 Provide each UV reactor with an automatic mechanical sleeve wiping system for the lamp sleeves. The wiping system shall be initiated through the UV microprocessor.

.2 The number of wiping strokes per interval will be factory preset and be easily reset by the Operator. Manual cleaning system control is to also be through the Operator Interface.

.3 The useful life of the wiper brush or cleaning device in contact with the quartz sleeve is to be in excess of two years.

.4 The cleaning system will maintain uniform wiping tension and cleaning over complete wiping length of the quartz sleeve and the UV sensors.

.5 The wiper rings will be fabricated of food-grade Viton rubber or equal.

.6 The system will be capable of continuous disinfection while automatically cleaning the UV sleeves without compromising system performance.

.8 UV Sensor:

.1 Provide each UV system with the duty UV sensor(s) tested in accordance with the submitted validation documentation, which will continuously sense the UV intensity produced in each UV reactor. The UV sensor will be calibrated by the Supplier.

.2 Provide a reference UV sensor to be used to calibrate each duty sensor, in addition to the duty UV sensor. The reference sensor will be interchangeable with the duty sensor. Include instructions detailing the calibration of the duty sensor with the Operations and Maintenance Manuals. The Supplier will provide a location and contact information for parties qualified to calibrate the reference UV sensor.

.9 Electrical and Controls:

.1 Provide one (1) Control Panel for each UV reactor, so that all control hardware and software for a given reactor is contained within the associated Control Panel.

.2 Each Control Panel enclosure:

.1 Type 12 painted mild steel, ventilated, and forced air cooled.

.2 Provide with a lockable disconnect handle that will shut down the reactor/cabinet power when the cabinet door is opened.

.3 Each UV reactor will be powered from a Control Panel by means of a waterproof cable interfacing with a watertight strain relief supplied by the UV supplier.

.4 Each UV unit shall be controlled by a local power distribution centre in the Control Panel equipped with electronic

microprocessor allowing for local control based on the UV sensor, flow rate, and target dose. The local control will monitor alarms and automatically shut down the unit due to critical faults.

.5 Provide interfacing between the UV local control centre and the plant PLC.

.6 Hardwire all discrete and analog I/O's.

.7 Provide minimum of five (5) 4-20 mA analog inputs. Provide minimum seven (7) configurable non powered discrete dry contact outputs rated at 24 VDC, and one (1) 4-20 mA output.

.9 Electrical supply to each Control Panel: 208 V, 1 Phase, 60 Hz, 2 wire plus 1 ground.

.10 Feed each UV system instrumentation and appurtenances control power from the UV control panel.

.11 The ballasts shall be microprocessor controlled, and be installed in easy to access ports.

.12 Each ballast shall not run more than 2 lamps.

.13 Configure each control panel with a control selector (REMOTE-OFF-LOCAL), power level selector, power on display, status of each lamp, UV intensity display, current dose display, low UV intensity alarm, high water temperature alarm, high cabinet temperature alarm, and hours run counter.

.14 In LOCAL mode the reactor will operate at either 100% output or based on the validated dose equation. This will be the default in the event of a UV control system failure. In REMOTE mode the plant PLC/SCADA will control the on/off cycles and monitor the system performance. In OFF mode the system will be shut down.

.15 Configure each UV Controller to provide the following outputs:

.1 UV dose (4-20 mA)

.2 System Warming (dry contact)

.3 UV System On-Line (dry contact)

.4 Minor alarm (indicates maintenance is required) (dry contact),

.5 Major alarm (indicates immediate action is required to ensure disinfection is not compromised) (dry contact).

.6 Critical alarm (the UV Controller has shut down the reactor) (dry contact).

.16 The Controller shall be configured to receive the following inputs:

.1 Flow transmitter, 4-20 mA isolated current input.

.2 UV Start/Stop signal, non-powered dry contact.

.17 Output the following alarms (by the UV controller to the plant PLC):

.1 UV Reactor Critical Alarms: The following critical alarms will be issued to the plant PLC as a Common Critical Alarm. The UV controller will immediately initiate a reactor shut down. The standby reactor shall then be brought on-line.

Description	**Type**
Over Temperature Fault	Critical
Dust Cap Removed	Critical

.2 UV Reactor Major Alarms: Issue the following major alarms to the plant PLC as a Common Major alarm.

Description	**Type**
Low UV Dose	Major
Lamp Fault	Major
Ballast Fault	Major
Low Validated Dose	Major
Low UV Intensity	Major
High Flow	Major

.3 UV Reactor Minor Alarms: Issue minor alarms to the plant PLC as a Common Minor Alarm. Minor alarms shall be shown in the alarm history. A minor alarm indicates maintenance is required and includes the following:

Description	Type
Lamp Runtime Hours Exceeded	Minor
Wiper Fault	Minor

.18 Safety Features:

.1 Critical interlock conditions include a high reactor temperature alarm and will initiate reactor shut down regardless of signal from the plant PLC.

.2 UV reactors will be equipped with a temperature switch to prevent the reactor from overheating. The temperature switch is to be wired to the UV Control Panel and is to shut the reactor down and issues a critical alarm when activated.

.3 UV reactors will be equipped with a cover to protect the lamps electrical connections. For Operator safety, the protective cover will be equipped with a switch to disconnect power to the lamps when the cover is removed.

.4 UV control panels and reactors will be equipped with an Emergency Stop to shut off power to the lamps.

.19 Basis of Design:

.1 Trojan Technologies, London, Ontario, Canada (Ramtech Environmental: ph (403) 221-8585)

.20 Spare parts and safety equipment to be supplied:

.1 3 UV lamps

.2 6 sleeves

.3 1 set of seals and o-rings per reactor

.4 1 set of replacement wiper seals per reactor

.5 1 Face Shield, able to block UV light wavelengths between 200 to 400 nm

PART 3 EXECUTION

3.1 Examination

.1 Take critical site dimensions to ensure tolerances and clearances to other construction are maintained, and that necessary

adjustments are made to adapt work of this section during its installation.

.2 Ensure anchors, services and similar provisions, installed by others, are adequate to meet specified requirements, and make adjustments before installation.

.3 Do not proceed with work of this section until conditions and work on which it depends are satisfactory with limitations of adjustment.

3.2 Shipping, Handling and Storage

.1 Store equipment and materials in a cool dry location and protected from the elements according to the UV Supplier's instructions.

.2 Handle equipment and materials in accordance with the Manufacturer's recommendations.

3.3 Installation

.1 Install equipment per the manufacturer's instructions.

.2 Confirm the installation as set out and provide clearance for easy access to all components and safe maintenance operations.

.3 Provide drawings, showing the UV reactor supports, foundation pad and anchor bolts required for all equipment to be supplied under this contract. Provide design drawings for all UV reactor supports, pads and anchor bolts, designed for the seismic conditions existing at the work site as prescribed in the National Building Code 2015 or BC Building Code 2012, whichever is more stringent. Drawings to be stamped by an engineering registered in BC.

3.4 System Testing and Commissioning

.1 Test the system after completion of the installation, to demonstrate system operation and all associated alarms and controls are operating as specified. Testing shall be done on-site with the UV manufacturer's factory trained field representative.

.2 Provide on-site training performed by the UV manufacturer`s factory trained field representative, in the presence of the Departmental Representative, in the operation, cleaning and maintenance of UV equipment provided under this section. Refer to Section 01 91 00 – General Commissioning Requirements.

3.5 Start-Up and Training

.1 Field test the system for proper operation. Once satisfied that the system is functioning properly and all equipment and field tests are

complete the system operation is to be performed in the presence of the Departmental Representative.

.2 If the system fails to perform, make the necessary repairs and modifications.

.3 Demonstrate communication between the UV system controller and the plant PLC in the presence of the Departmental Representative.

.4 Perform the following services:

.1 Test, calibrate and adjust all components for optimal performance.

.2 Assist in initial start-up and field testing.

.5 Provide one (1) day of on-site training by the UV manufacturer`s factory trained field representative with Operations staff. Schedule and coordinate training with the Supplier and the Operations staff.

3.6 Touch-Up

.1 Upon completion, touch-up and restore to new condition, damaged or defaced factory finished surfaces.

.2 Remove protective coverings and clean exposed surfaces after completion.

END OF SECTION

PART 1 GENERAL

1.1 Scope	.1	Supply and install a sodium hypochlorite system in the water treatment plant, including one day tank and spill deck, duty and standby metering pumps, sodium hypochlorite feed and containment piping, injector, wafer style static mixer, and all associated appurtenances.
	.2	The package sodium hypochlorite system provides sodium hypochlorite (NSF 60 approved 12% sodium hypochlorite, diluted 4:1) injection to the supply line located inside of the water treatment plant.
1.2 Related Sections	.1	Section 01 33 00 – Submittal Procedures
	.2	Section 01 78 00 – Closeout Submittals
	.3	Section 01 79 00 – Demonstration and Training
	.4	Section 01 91 00 – General Commissioning Requirements
	.5	Section 01 91 01 – Equipment and System Performance and Operational Testing
	.6	Section 11 09 25 – Analytical Monitoring
	.7	Section 22 05 00.01 – Mechanical General Requirements
	.8	Section 22 11 16.01 – Piping Systems
	.9	Section 22 42 01.03 – Anchor Bolts
1.3 References	.1	N/A
1.5 Shop Drawings	.1	Provide fully dimensioned drawings showing construction, operation and principal dimensions of the sodium hypochlorite system and all associated equipment, and submit as specified in Section 01 33 00 Submittal Procedures. Also, submit a fully detailed Bill of Materials for review, including all equipment and material specifications.
	.2	Shop drawings are to include Operations and Maintenance manuals, including recommended spare parts list with the current price and supplier of the parts listed and maintenance schedule.

PART 2 - PRODUCTS

2.1 Shipping and Handling of Equipment

.1 Store equipment and materials in a cool dry location and protected from the elements according to the Manufacturer's instructions.

.2 Handle equipment and materials in accordance with the Manufacturer's recommendations.

.3 Consult and follow all safety procedures with regard to handling of 12% sodium hypochlorite.

2.2 Components

.1 Provide a panel mounted sodium hypochlorite system that includes one package of duty/standby metering pumps to dose sodium hypochlorite to the drinking water system supply line.

.2 The maximum system pressure in the supply main at the sodium hypochlorite injection point is 414 kPa.

.3 Features:

.1 Provides a chlorine dose of 0.4 mg/L to 2.0 mg/L as free chlorine.

.2 Feed rate of each metering pump: 0.1 mL/min – 16.0 mL/min.

.3 Guaranteed to operate at the flow rates as specified herein and operate satisfactorily in all respects under the specified operating conditions.

.4 Flow-proportional and manual control chlorine metering system.

.5 Interface capabilities of each pump:

.1 Dry-contact "run" input from plant PLC.

.2 120 V rated, dry-contact "fault" output to plant PLC.

.3 120 V rated, dry-contact "running" output to plant PLC.

.4 Storage tank low level input from float switch included in package.

.6 Unit operates from 120 VAC, single phase service and the pumping capacity varies in proportion to a 4-20 mA analog control signal. Solenoid operated type pumps will have a manually adjustable stroke length from 10% to 100%.

.7 Provide liquid end with provision for auto degassing and suitable for sodium hypochlorite service.

.8 Pump package comes pre-configured as follows:

.1 Pump Back Pressure Valve

.2 Pump Relief Pressure Valve

.3 1 – Back/Relief Pressure setup gauge

.4 Pulsation dampener

.5 Calibration column with minimum 30s capacity at maximum pump flowrate

.6 1 - Visual flow monitor

.7 Strainer with 40 mesh screens (if positive inlet pressure)

.8 Piping: Sch. 80 PVDF material

.9 Isolation ball valves provided as required

.10 Pump and appurtenances mounted on a common corrosion resistant stand

.11 Front accessible user interface display/keypad

.12 Factory tested prior to shipment

.9 Basis of Desgn:

.1 ProMinent (Gamma/X Series) (Smith-Cameron (604-596-4505))

.4 Provide the following Sodium Hypochlorite System Accessories:

.1 One (1) PVC chemical injector for 12% sodium hypochlorite, including a corporation stop valve complete with injector quill, shut-off valve and spring loaded check valve.

.2 Wafer style static mixer, complete with integral 6 mm injection port suitable for 12% sodium hypochlorite at the design flow rate. Basis of design is Westfall.

.3 Contain sodium hypochlorite polyethylene feed lines in clear PVC containment piping from the pump skid to the injection point. Provide a tee and ball valve with drain at the low point(s).

.5 Provide (configuration as per the schematic on drawings):

.1 PE 60 L chemical tank, complete with two single stage low level alarm float switches, for direct connection to each pump.

.2 Foot valve c/w 40 mesh strainer (if suction lift).

.3 Spill Containment Pallet for tank.

.6 Supply the following supplemental personal protective equipment:

.1 one (1) chemical full face shield.

PART 3 - EXECUTION

3.1 Examination

.1 Take critical site dimensions to ensue tolerances and clearances to other constructions have been maintained, and necessary adjustments are made to adapt work of this section during its installation.

.2 Ensure anchors, services and similar provisions, installed by others, are adequate to meet specified requirements, and make adjustments before installation.

.3 Do not proceed with work of this section until conditions and work on which it depends are satisfactory with limitations of adjustment.

3.2 Defects

.1 Examine each item of equipment thoroughly for damage or defects before installation. Should any damaged or defective equipment be found it is to be removed and replaced at the Contractor's expense and to the satisfaction of the Departmental Representative.

3.3 Installation

.1 Install equipment per the manufacturer's instructions.

.2 Install the equipment with direction from the Manufacturer. Once the piping is installed, tested and disinfected to the satisfaction of the Departmental Representative, arrange with the Manufacturer for on-site final calibration of the units and training with water treatment plant Operations staff.

3.4 Touch-Up

.1 Upon completion, touch-up and restore to new condition, damaged or defaced factory finished surfaces.

.2 Remove protective coverings and clean exposed surfaces after completion.

3.5 Commissioning

.1 The Manufacturer's field technician is to conduct on-site final calibration of the units in the presence of the Departmental Representative and provide all necessary field training.

.2 Commission the system as per Section 01 91 00 General Commissioning Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 Furnish and install analytical monitoring components within the system, including turbidity analyser.

.2 For all instrumentation, all labour, materials, components, and programming, and all design to be provided, assembly, and start-up services required to provide a complete and workable system.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures

.2 Section 01 78 00 – Closeout Submittals

.3 Section 01 79 00 – Demonstration and Training

.4 Section 01 91 00 – General Commissioning Requirements

.5 Section 01 91 01 – Equipment and System Performance and Operational Testing

.6 Section 22 05 00.01 – Mechanical General Requirements

.7 Section 22 11 16.01 – Piping Systems

.8 Section 22 42 01.03 – Anchor Bolts

1.3 References

N/A

1.4 Submittals

.1 Submit shop drawings for all analytical monitoring systems providing full details on make, sensor, transmitter, instrumentation tag number, full model number (with options clearly indicated), dimensions, wiring and power requirements, digital communication addresses (Modbus, Profibus, Foundation Fieldbus, etc.), and all installation accessories for each sensor.

1.5 Operation and Maintenance Manuals

.1 Provide at least four copies of original equipment manufacturer printed manuals for insertion within the general project operation and maintenance manuals. These will include at a minimum:

- .1 Full User Manual
- .2 Installation Instructions
- .3 Full list of Parameters/Programming Manual
- .4 Troubleshooting/Maintenance Manual

.2 A complete list of all parameters programmed into each instrument at the end of commissioning will be provided for insertion within the general project operation and maintenance manuals. These lists will be clearly sorted by instrument tag number.

PART 2 - PRODUCTS

2.1 Shipping and Handling of Equipment

.1 Store equipment and materials in a cool dry location and protected from the elements according to the Manufacturer's instructions.

.2 Handle equipment and materials in accordance with the Manufacturer's recommendations.

2.2 Turbidity Analyzer

.1 Provide a water turbidity monitoring system suitable for turbidity change of 0 to 40NTU and accuracy within 2%.

.2 Features:

.1 Comes equipped with a single-line alphanumeric display, 4-20mA analog output and power supply suitable for 120VAC 60Hz input.

.2 Incorporates a time adjustable auto-clean wiper system to eliminate optical fouling of the sensor. Provide a LED as the light source, integral to the flow chamber.

.3 Includes a dry calibration standard capable of accurate and repeatable zero and span calibration/verification.

.4 Includes a de-bubbler capable of expelling air from the sample prior to the sample entering the analyser.

.5 Basis of design for turbidity monitoring system: ABB Series 4690 sensor and transmitter complete with dry calibration block and de-bubbler as available. For Delpro Automation call 604-517-5599.

.5 Ensure Manufacturer provides a field technician to conduct 'on-site' final calibration of the unit in the presence of the water treatment plant operating personnel, and provide all necessary field training.

PART 3 - EXECUTION

3.1 Examination

.1 Take critical site dimensions to ensure tolerances and clearances to other constructions have been maintained, and necessary adjustments are made to adapt work of this section during its installation.

.2 Do not proceed with work of this section until conditions and work on which it depends are satisfactory with limitations of adjustment.

3.2 Defects

.1 Examine each item of equipment thoroughly for damage or defects before installation. Should any damaged or defective equipment be found it is to be removed and replaced at the Contractor's expense and to the satisfaction of the Departmental Representative.

3.3 Installation

.1 Install equipment per the manufacturer's installation guidelines.

.2 Install the equipment with direction from the Manufacturer. Once the piping is installed, tested and disinfected to the satisfaction of the Departmental Representative, arrange with the Manufacturer for on-site final calibration of the units and training with water treatment plant Operations staff.

3.4 Touch-Up

.1 Upon completion, touch-up and restore to new condition, damaged or defaced factory finished surfaces.

.2 Remove protective coverings and clean exposed surfaces after completion.

3.5 Commissioning

.1 Provide assistance to the Departmental Representative for the testing and commissioning of the instrumentation.

.2 Commission the system as per Section 01 91 00 General Commissioning Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 This Section outlines general requirements for mechanical works on the project.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 45 00 – Quality Control.

1.3 References

.1 Within text of each specifications section, reference may be made to reference standards. Conform to these reference standards, in whole or in part as specifically requested in specifications.

.2 Conform to latest date of issue of referenced standards in effect on date of submission of Tenders, except where specific date or issue is specifically noted.

1.4 Submittals

.1 Submit product data, shop drawings, and installation instructions of mechanical equipment for review were indicated in the specifications.

1.5 Quality

.1 Incorporated only new products, materials, equipment and articles in the Work, not damaged or defective, and of best quality (compatible with specifications) for the intended purpose. If requested, furnish evidence as to type, source and quality of products provided.

.2 Defective products, whenever identified prior to completion of Work, will be rejected, regardless of previous inspections. Inspection does not relieve responsibility, but is precaution against oversight or error. Remove and replace defective products at own expense and be responsible for delays and expenses caused by rejection.

.3 Should any dispute arise as to quality or fitness of products, decision rests strictly with Departmental Representative based upon requirements of Contract Documents.

.4 Upon written request by the Departmental Representative, submit following information for material and equipment proposed for supply:

.1 Name and address of manufacturer.

.2 trade name, model and catalogue number,

.3 performance, descriptive and test data,

.4 manufacturer's installation or application instructions,

.5 evidence of arrangements to procure.

.5 Use products of one manufacturer for material and equipment of same type or classification unless otherwise specified.

.6 Permanent labels, trademarks and nameplates on products are not acceptable in prominent locations, except where required for operating instructions, or when located in mechanical or electrical rooms.

.7 All mechanical equipment and piping materials supplied under this Contract shall be of current manufacture.

.8 All workmanship shall be of the highest quality and sub-standard work will be rejected.

1.6 Familiarity with Project Requirements

.1 No claim will be considered for additional work on the grounds that the Contractor did not anticipate actual requirements.

.2 Provide complete and workable systems as outlined in the specifications and on drawings, including all field wiring and field run piping required for all equipment supplied. The Departmental Representative will not recognize any sub-contractor as such, but will consider all persons engaged on the work to be under the control of the Contractor.

.3 The Departmental Representative will not, under any circumstances, enter into discussions concerning the responsibility of subtrades or the apportionment of work. No claim based on the division of work between specification sections will be considered.

.4 Assume responsibility for site safety.

1.7 Permits and Inspection

.1 Become fully acquainted with all codes and bylaws relating to the installation of equipment. Obtain and pay for all permits required for the execution and inspection of the work and pay all charges relating to such permits.

1.8 Substitutions

.1 Supply approved equipment exactly as indicated by the drawings and specifications.

.2 Alternate materials may be substituted by the Contractor only if such substitutions have been approved in writing by the Departmental Representative.

PART 2 - PRODUCTS

2.1 Shop Drawings

.1 A review of the Contractor drawings and bill of material shall be undertaken to determine the general conformance of the equipment with the design concept, but will not relieve the Contractor of any obligation in the Contract nor of his responsibility for any errors or omissions.

2.2 Handling and Storage of New Equipment

.1 Adequately protect all equipment from damage during handling and from dust, dampness or any other injurious substance during delivery to the site, while at the site and after construction.

.2 Make good any damage which may occur during handling, shipping, or installation, at no extra cost to the Contract.

.3 Cover equipment stored in unheated or open areas on the site, and provide with thermostatically controlled heaters of sufficient size to keep temperature of the equipment above the dew point.

.4 Make storage areas accessible to the Departmental Representative at any time for the determination of the condition of storage.

2.3 Inspection

.1 The Departmental Representative reserves the right to inspect and test any material to be supplied under this specification at the manufacturer's plant or after arrival at the location specified for delivery.

.2 Replace all materials, components, or parts which do not meet these specifications, the standards, or are defective, to the satisfaction of the Departmental Representative and at no extra cost to the Department.

PART 3 EXECUTION

3.1 Not Applicable

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 This specification refers to the supply, delivery and installation of:

.1 Two submersible pumping units, each with submersible motors, for installation into 200mm Primary well and 150mm Reserve well.

.2 Supply and installation of two pitless units, and related appurtenances, for installation onto the existing 150 m well and 200mm well – Utilize the piles unit spools for the installation of the well type submersible pumping units.

.3 Motor control will be with a variable speed drive as per electrical drawings and specifications.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 01 35 33 – Health and Safety Requirements.

.3 Section 01 79 00 – Demonstration and Training.

.4 Section 01 91 01 – Equipment and System Performance and Operational Testing.

.5 Section 22 05 00.01 – Mechanical General Requirements.

1.3 References

.1 Equipment and materials supplied under this specification to meet:

.1 Hydraulic Institute Standards

.2 Canadian Government Specification Board Standards

.3 Standards of the Electrical and Electronic Manufacturer's Association of Canada

.4 Canadian Standards Association

1.4 Submittals

.1 Provide dimensioned sketches included with illustrated literature describing the proposed equipment.

PART2 - PRODUCTS

2.1 Delivery, Storage and Handling

.1 Equipment and materials shall be stored in a cool dry location and protected from the elements according to the manufacturer's instructions.

.2 Equipment and materials shall be handled in accordance with the manufacturer's recommendations.

2.2 Submersible Pumping Unit

.1 Provide submersible raw water pumps that are water lubricated, multi stage, submersible motor driven and have a maximum external diameter of 100 mm.

.2 Design the pump to satisfy the following conditions:

Rated Capacity Litres/second	Total Dynamic Head (TDH) at Rated Capacity Metres
4	56.1

.3 Provide pump impellers and diffusers fabricated from 300 series stainless steel and incorporate an integral poppet type check valve for pump discharge.

.4 Include cutless rubber bearings, on intermediate bowls, to support and guide the shaft and lend resistance to sand abrasion wear on the shaft bearing surface.

.5 Provide suction screen of 300 series stainless steel with a net open area at least four times the area of the impeller eye.

.6 Pump discharge: 50mm FNPT.

.7 Integrally mounted with each pump will be a water filled 5 HP submersible motor with a minimum 1.15 service factor and sufficient continuous thrust capacity.

.1 Motor operating efficiency no less than 70%.

.2 Mounting base and shaft extension to NEMA standards.

.3 Motor suitable for 575 Volt, 60 Hz, three phase service.

.4 The motor is to be rated for inverter duty for use with variable speed drives.

.8 Basis of Design:

.1 Submersible pumps: Grundfos 60S50-9.

.2 Motors: Franklin Sand fighter Model 234 337 8802.

.9 Ensure that the installation of pumping equipment fully complies with the requirements of the pump and motor manufacturers, and provide a letter of certification that these requirements have been met.

2.3 Submersible Pump Cable

.1 Protect motor leads for the entire length of the bowl assembly by a 300 series stainless steel cable guard supplied with the pump.

.2 Size type TWU or RWU stranded submersible pump cable such that the voltage drop will not exceed 3% from the power source to the motor at full load current.

.3 Splice power conductors to the motor leads within the well using crimp connectors and heavy duty heat shrink insulation with adhesive. Basis of Design is T&B HS Series.

.4 Include a ground conductor terminating at a motor stud ring connector.

.5 Attach pump cable to the discharge riser pipe by means of vinyl electrical tape applied in a 50mm wide multi-wrap band a minimum of every 2m.

.6 Terminate pump cables in the pump disconnect switch.

2.4 Discharge Riser Pipe

.1 Discharge riser pipe:

.1 SCH40S 316L Stainless Steel Pipe.

.2 Increase diameter from 50mm to 80mm one pipe length above the pump.

.2 Random length (4.8m-6.7m, or 16'-22') 50mm and 80mm diameter, Schedule 40S steel with standard merchant taper tapped threaded couplings.

.2 Use Nickel/Teflon tape on all male threaded ends

.3 Food Grade Anti-Seize Lubricant in all couplings.

.1 Basis of Design: Loctite

.4 Utilize an NPT screw ring gauge to check all threaded riser pipe ends, and demonstrate to the Departmental Representative on request.

.5 Ensure that riser pipe penetration into each coupling end is at least:

Pipe Size	Minimum End Penetration
50 mm	19 mm
80 mm	25 mm
100 mm	29 mm
150 mm	33 mm
200 mm	37 mm

.6 Pump cable shall be attached to the discharge riser pipe by means of vinyl electrical tape applied in a 50mm wide multi-wrap band a minimum of every 2m.

2.5 Check Valve

.1 Provide an 80mm low head loss dual poppet type check valve of ductile iron construction with stainless steel trim.

.2 Basis of Design: Flomatic Model 80DI VFD.

.3 Note that check valve to be installed one pipe length below pitless unit.

2.6 Level Transmitter Insert Tube

.1 Extend a tube made of solvent coupled 25mm Schedule 40 PVC pipe (26.6 mm ID) from grade level to just above the pump discharge (attached to the discharge riser pipe, along with the pump cable).

.2 Terminate the bottom of insert tube with a cap to serve as a transmitter end stop. Drill 4x ¼" holes in top and bottom of the tube for equalization.

2.7 Pitless Units

.1 Supply, deliver and install factory assembled vented pitless units to completely replace the upper portion of the existing 200mm Primary well and 150mm Reserve well.

.1 Pitless units epoxy coating: NSF61 approved.

.2 Cap shall be watertight and of cast iron construction, or epoxy coated steel, with electrical cable seal.

.3 Primary well pitless unit case: nominal 200mm diameter well size with a 225mm upper casing size and be suitable for butt welding to the top of the sectioned well casing.

.4 Reserve well pitless unit case: nominal 150mm diameter well size with a 175mm upper casing size and be suitable for butt welding to the top of the sectioned well casing.

.5 Minimum discharge pressure rating: 2070kPa.

.6 Discharge body: cast ductile iron or steel.

.7 Discharge connection: 80mm, FNPT.

.8 Internal hold-down mechanism and lift-out pipe and bail: cast iron or steel, 80mm FNPT riser pipe connection and the following features for each unit:

- 1x25mm through spool probe level transmitter insert tube.
- 3x15mm through spool power cable sealed stainless steel passages.
- 50mm nominal lift out pipe and bail assembly rated 6,800 kg and two hold-down clamps.

.9 Pitless unit assemblies to have ANSI/NSF-61 approved epoxy coating for potable water.

.10 Basis of Design for the pitless unit for the Primary well: Baker Standard Pitless Unit – NSF Certified 8x10:

.1 3.5PS810WBWE03E3X 8x10 Pitless.

.11 Basis of Design for the pitless unit for the Reserve well: Baker Standard Pitless Unit – NSF Certified 6x7:

.1 3.5PS67WBWE03E3X 6x7 Pitless.

.2 Supply three (3) sets of spare 0-rings and gaskets for each unit.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2	Installation	.1	Make piping and electrical connections to pump and motor assembly and controls as indicated.
3.3	Field Quality Control	.1	Check power supply.
		.2	Check starter protective devices.
		.3	Start-up, check for proper and safe operation.
		.4	Complete manufacturer pump and motor check lists and start-up forms. Provide as part of O&M Manual.
3.4	Testing and Training	.1	Install all submersible pumping equipment in compliance with the requirements of the pump manufacturer, and provide a letter of certification that these requirements have been met.
		.2	Conduct operational testing in accordance with Section 01 91 01 Equipment and System Performance and Operational Testing.
		.3	Conduct training in accordance with Section 01 79 00 Demonstration and Training.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 This section describes the requirements for pipe materials, fittings, appurtenances, and the process mechanical and plumbing.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 22 42 01.02 – Seismic Restraints.

.3 Section 22 42 01.03 – Anchor Bolts.

.4 Section 33 11 16 – Site Water Utility Distribution Piping.

1.3 References

.1 National Building Code 2015 and BC Building Code 2012, follow whichever is more stringent.

.2 ANSI B31.3 - Normal Fluid Service.

.3 PVC pipe to be CSA B137.3

.4 CPVC pipe to be CSA B137.6

1.4 Definitions

.1 Pressure terms used in this and other related sections are defined as follows:

.1 Maximum pressure: The greatest constant pressure at which the piping system operates.

.2 Test pressure: The hydrostatic pressure used to determine system compliance.

.2 Pipe and appurtenance location terms used in this and other related sections are defined as:

.1 Pump Houses, Valve Chambers and Buildings: Within an environmentally controlled enclosure where temperature is maintained above 5°C.

.2 Exposed, Aboveground: Outside or within an enclosure which is not environmentally controlled so that the temperature is maintained above 5°C. For the purpose of defining exterior protection systems, this definition is extended to vertical piping to a point of 0.5 metres below finished ground level.

.3 Underground (or buried): Placed in soil and not tied to structures.

.4 Below Structures: Below concrete slabs such as tanks, channels, buildings, pipe chases, foundation slabs, etc.; but not

including roadways or walkway structures.

.5 Submerged: Regularly or occasionally immersed in liquid; inside tanks and/or channels, and within 3.0 metres above maximum water level of open tankage. Includes pipe and appurtenances within manholes, vaults and chambers

1.5 Submittals for Review

.1 For each piping system, submit document listing pipe, fittings, flexible connectors, linings, coatings, and valving to be used for each pipe size and category.

.2 Provide the necessary submittals and ensure the piping systems and system components are fabricated in accordance to ANSI B31.3, Normal Fluid Service.

.3 For all pipe greater than or equal to 50mm diameter, submit isometric drawings, to indicate the assembly details, the welds, flanges, valve placement, cathodic protection, seismic restraint system, expansion joints, guides, anchors, hangers, supports, and the provisions for thrust restraint, as well as any other pertinent details.

.4 Submit piping layout and section drawings by plant area which indicate location and placement of valves, fittings and other appurtenances for all piping, greater or equal to 50 mm diameter, in that area. Indicate overall and centre-centre dimensions and location and clearances from structures and other utilities (ductwork, conduit, electrical tray, etc.).

.5 Where specified or directed by the Departmental Representative, provide mill test results or product samples.

.6 Design, select, locate and provide piping supports, pipe guides, seismic bracing, expansion joints and anchors required for final piping layout. Typical details and acceptable attachments shown on the drawings are provided only for general guidance.

.7 Detail all the pipe supports required on this project and provide shop drawings with the location of supports and details of all the hangers, expansion joints, guides and support systems. Drawings are to be signed and stamped by a Professional Engineer registered in British Columbia. Refer to Section 22 42 01.02 Seismic Restraints for Post Disaster seismic requirements.

.8 Piping supports and seismic bracing are generally not shown on the mechanical layout drawings. Piping supports and seismic bracing, if

shown on drawings, are for reference only.

1.6 Coordination of Pipe Sleeves

.1 Coordinate with other divisions and, prior to construction, locate, and place sleeves in cast-in-place concrete.

1.7 Quality Assurance

.1 Installers to be certified to journeyperson.

.2 In cases of conflict:

.1 Review the drawings prior to installation of piping, conduit services, and fixtures by this or any other division. Identify any conflicts and cooperate with the Departmental Representative to determine the adjustments necessary to resolve these conflicts.

.2 Confirm the routing of each section of pipework with other services prior to commencement of installation. Advise the Departmental Representative of any conflicts with existing services or services yet to be installed. Where necessary, amend the routing of pipework to avoid conflict and confirm with the Departmental Representative.

.3 Quality Assurance for shipment, protection and storage is to include:

.1 Deliver pipe, fittings, and specials to site using loading methods which do not damage pipe or coatings.

.2 Piping materials delivered to site will be clearly marked to indicate size, type, class/schedule and coatings.

.3 Until ready for incorporation in the work, store on site as recommended by the piping materials manufacturer to prevent damage, undue stresses, or weathering.

.4 Store materials at least 200 mm above ground with sufficient supports to prevent undue bending.

.5 Protect non-UV light inhibited plastic from sunlight.

PART 2 - PRODUCTS

2.1 General

.1 Provide the pipe materials, fittings, and appurtenances as described below, for the piping systems shown.

.2 All pipe materials to be new, free from defects.

.3 Where any standard referenced has been superseded prior to

bidding, comply with the new standard.

2.2	PVC Piping	.1	Where indicated on drawings, fabricate process PVC piping from schedule 80 PVC (polyvinyl chloride) pipe certified to CSA B137.3.
		.2	Where indicated on drawings, fabricate CPVC piping from schedule 80 CPVC (chlorinated polyvinyl chloride) pipe certified to CSA B137.6.
		.3	Reduce pressure rating by 50%, if threaded,.
		.4	De-rate pressure rating per manufacturer's instructions, if grooved.
		.5	Base temperature de-rating on a room temperature of 30 °C.
		.6	Do not use PVC for hot water applications.
2.3	Plumbing Pipe Sizes - Plumbing Systems	.1	Where the pipe size is not specified, provide pipe with the sizes required by the National Building Code. Small piping not described by the National Building Code is not to be less than 12 mm nominal diameter.
		.2	Install all plumbing piping as per the National Building Code.
2.4	Pipe Supports	.1	Contractor is to design, supply and install all pipe supports and anchors. Piping drawings to be signed and sealed by a Professional Engineer registered in British Columbia to meet all applicable building and seismic codes. Refer to Section 22 42 01.02 Seismic Restraints for Post Disaster seismic requirements.
		.2	Provide galvanized miscellaneous pipe support steel as per the structural specification unless otherwise shown on the drawings. Threaded rods are not to be painted and are to be of corrosion resistant materials compatible with the service to which they are being provided. Conform anchor bolts to Section 22 42 01.03 Anchor Bolts.
		.3	Provide AISI Type 316 stainless steel constructed pipe supports for all supports not regularly or occasionally immersed in liquid, otherwise shown on the drawings.
		.4	Threaded rods are not to be painted and are to be of corrosion resistant materials compatible with the service to which they are being provided.

PART 3 - EXECUTION

3.1	Preparation	.1	Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
		.2	Make all minor modifications to suit installed equipment and structural element locations and elevations.
		.3	Piping arrangements indicated on the drawings have been established on the basis of the "Design Standard" listed in the specific process equipment sections. If the equipment to be provided is not the Design Standard, at no additional expense to the District, modify the piping arrangement as necessary.
		.4	Advise the Departmental Representative of all modifications. Do not commence work on the related piping until all modifications have been reviewed by the Departmental Representative.
		.5	Include any piping modifications in the shop drawings submitted prior to fabrication or installation.
3.2	Pipe Handling	.1	Inspect each pipe and fitting prior to installation. Do not install damaged pipe or pipe with damaged protective coatings.
		.2	Remove all foreign matter from inside of pipe prior to installation.
		.3	Repair pipe with damaged protective coatings with material similar to the original in accordance with the manufacturer's directions and to the satisfaction of the Departmental Representative.
		.4	Use proper implements, tools, and facilities for the proper protection of the pipe. Exercise care in the installation so as to avoid damage to pipe or coatings.
3.3	Clearances	.1	Provide clearance around systems, equipment and components for observation of operation, inspection, servicing, maintenance and as recommended by manufacturer.
		.2	Provide space for disassembly, removal of equipment and components as recommended by manufacturer or as indicated (whichever is greater) without interrupting operation of other system, equipment and components.
3.4	Sleeves	.1	Unless otherwise noted or approved by the Departmental Representative, provide sleeves where piping passes through a wall,

floor or ceiling.

.2 Locate and place sleeves prior to construction of cast-in-place elements and prior to the construction of concrete and masonry building elements.

3.5 Pipe Installation - General

.1 Installation by certified journeyperson.

.1 The types and sizes of pipes to be used are as specified and shown. Where sizes of small pipe are omitted from the drawings and not mentioned in the specifications, the sizes to be used will be determined by the Departmental Representative.

.2 Carefully place and support all pipe at the proper lines and grades, and slope where possible to permit complete drainage. Follow piping runs shown on the drawings as closely as possible, except for minor adjustments to avoid architectural and structural features. If major relocations are requested, submit plans to the Departmental Representative for approval.

.3 Use a sufficient number of screwed unions, flanged or grooved end type joints in erecting the pipe, to allow any section or run of pipe to be disconnected without interfering with, or removal or adjacent pipe runs.

.4 Provide the required number of take-down fittings, along straight runs of pipe.

.5 Provide take-down fittings, after every second bend or fitting.

.6 Provide take-down fittings to allow for the removal of valves, strainers, equipment, in-line instrumentation, and all other appurtenances along the piping rows.

.7 Provide take-down fittings where-ever a pipe passes through a concrete or masonry wall.

.8 Install exposed piping, equipment, rectangular cleanouts and similar items parallel or perpendicular to building lines.

.9 Install concealed pipework to minimize furring space, maximize headroom, conserve space.

.10 Slope piping, except where indicated, in direction of flow for positive drainage and venting.

.11 Install, except where indicated, to permit separate thermal insulation of each pipe.

.12 Group piping wherever possible and as indicated.

.13 Ream pipes, remove scale and other foreign material before assembly.

.14 Use eccentric reducers at pipe size changes to ensure positive drainage and venting.

.15 Provide for thermal expansion as indicated.

3.6 PVC Welding

.1 Join PVC & CPVC pipe and socketed fittings by use of solvent based cements manufactured in accordance with ASTM D 2564.

.2 Square cut ends of pipe; clean pipe and sockets of fittings; and remove all dirt, grease and glossy finishes.

.3 Make joints in accordance with the pipe manufacturer's recommendations and conform to the recommended practice for making solvent-cemented joints described in ASTM D 2855. Prepare the ends of pipe and sockets of fittings with an approved pipe primer and coated with an approved solvent cement and pushed together. Where piping is to be joined to other materials or fittings, use suitable socketed adapters. Strictly adhere to manufacturer's recommendations where Victaulic®, Dresser®, Viking Johnson® or other connections are used.

.4 Primer/Solvent Cement: Make all socket type joints using primers and solvent cements that meet or exceed the requirements of ASTM F 656 and ASTM F 493 respectively. Use standard practices for safe handling of primer and cement in accordance with ASTM F 402. Both primer and cement shall conform to the requirements of NSF Standard 14. Use only CPVC primer and solvent cement when making CPVC solvent cement joints.

.5 Use 724 Weld-On Industrial Solvent, Tangit Dytex Special Solvent Cement or Xirtec 24 solvent cement for joining piping and fitting in contact with sodium hypochlorite.

3.7 Interior Installation

.1 Make adequate provision in piping and pipe support systems for expansion, contraction, slope, and anchorage.

.2 Install a pipe support system to adequately secure the pipe and to prevent undue vibration, sag or stress.

.3 Install expansion joints where shown and at other locations as necessary to allow for piping expansion and contraction.

.4 Provide temporary supports as necessary during construction to prevent overstressing of equipment, valves or pipe.

.5 Accurately cut all piping for fabrication to field measurements.

.6 Install pipes in straight alignment. Do not exceed 10 mm in 10 metres variance from the true alignment, in any direction. Fabricate and assemble pipe runs so that the pipework is not stressed to achieve the desired alignment and that no stresses are transferred to equipment or equipment flanges. The "springing" of pipework to ensure alignment is not permitted. Undo and subsequently remake all pipework connections where so instructed by the Departmental Representative to ensure that springing does not occur. Take care not to damage equipment, valves or flanges.

.7 Slope instrument air piping condensate traps. Provide condensate traps as recommended by the manufacturer of the instrument air compressor.

.8 Do not cut or weaken the building structure to facilitate installation.

.9 In parallel pipe runs, offset flanges and/or grooved joint fittings by a minimum of 200 mm.

3.8 Flushing Out of Piping Systems

.1 Perform in accordance with Section 33 11 16 Site Water Utility Distribution Piping.

.2 Before start-up, clean interior of piping systems as specified in relevant sections of other Divisions.

.3 Preparatory to acceptance, clean and refurbish equipment and leave in operating condition, including replacement of filters in piping systems.

3.9 Pressure Testing & Disinfection of Equipment and Pipework

.1 Pressure test and disinfect pipework in accordance with Section 33 11 16 Site Water Utility Distribution Piping.

.2 Advise Departmental Representative, 48 hours minimum prior to performance of pressure tests.

.3 Pipework: Test as specified in relevant sections of other sections or Divisions.

.4 Maintain specified test pressure without loss for 4 hours minimum unless specified for longer period of time in relevant sections of other Divisions.

.5 Prior to tests, isolate equipment and other parts which are not

designed to withstand test pressure or media.

.6 Conduct tests in presence of Departmental Representative. Work to be carried out in off hours after 5 p.m., weekends or holidays. Coordinate off hour access to the site with the Departmental Representative.

.7 Pay costs for repairs or replacement, retesting, and making good. Departmental Representative to determine whether repair or replacement is appropriate.

.8 Insulate or conceal work only after approval and certification of tests by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

1.1	Summary	.1	This section describes the requirements for pipe joints for the process mechanical and plumbing.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 22 11 16.01 – Piping Systems
		.3	Section 22 42 01.02 – Seismic Restraints.
		.4	Section 22 42 01.03 – Anchor Bolts.
		.5	Section 33 11 16 – Site Water Utility Distribution Piping.
1.3	Submittals for Review	.1	For each piping system, submit document listing pipe, fittings, flexible connectors, linings, coatings, and valving to be used for each pipe size and category.
		.2	Provide the necessary submittals and ensure the piping systems and system components are fabricated in accordance to ANSI B31.3, Normal Fluid Service.
		.3	Where specified or directed by the Departmental Representative, provide mill test results or product samples.
		.4	For expansion joints submit manufacturer's catalogue data, shop drawings and assembly drawings confirming general arrangement, dimensions, tolerances, materials of construction, weights and installation details. Submit calculations to substantiate expansion joint selection and amount of pre-compression, stamped and signed by a Professional Engineer registered in British Columbia.
1.4	Quality Assurance	.1	Installers to be certified to journeyperson.
		.2	In cases of conflict:
			.1 Review the drawings prior to installation of piping, conduit services, and fixtures by this or any other division. Identify any conflicts and cooperate with the Departmental Representative to determine the adjustments necessary to resolve these conflicts.
			.2 Confirm the routeing of each section of pipework with other services prior to commencement of installation. Advise the Departmental Representative of any conflicts with existing services or services yet to be installed. Where necessary,

amend the routing of pipework to avoid conflict and confirm with the Departmental Representative.

PART 2 - PRODUCTS

2.1 Joints - General

.1 Connect piping using joints not readily disassembled only where shown and where not otherwise specified. Provide joints which may be readily disassembled at the minimum within 1.0 m of any connection to equipment, on both sides of structural penetrations, within 0.6 m of all threaded end valves, and at the spacing specified in detailed piping specification sheets.

.2 For copper or brass piping, use soldered couplings. Where disassembly is required, use compression unions.

.3 Where not shown or otherwise specified, use solvent weld joints for PVC piping. Provide flanges or unions where disassembly is required.

.4 For stainless steel tubing use stainless steel compression fittings.

2.2 Flanges

.1 Material to ASTM D1784, Class 150, on PVC pipe, conforming to ANSI B16.5 and B16.1 for drilling and dimensions.

.2 General requirements for flanges are as follows:

.1 Compatible flanges for mating to equipment or valves.

2.3 Soldered Couplings

.1 Soldered couplings for copper pipe conform to ANSI B16.26. Solder will be lead free and conform to ASTM B32 and the NBC.

2.4 Grooved Joint Adapter

.1 Grooved joint Adapter:

.1 To be of made of PVC material.

.2 Coupling to be grooved by socket schedule 80.

.3 To have minimum working pressure of 1378 kPa.

.2 Basis of Design: Spears 2" PVC Grooved Coupling #833-020

2.5 Grooved Transition Coupling

.1 Transition connections between grooved PVC adapter and high-density polyethylene pipe:

.1 To be of ductile iron (ASTM A 536, Grade 65-45-12) with a pressure rating of 1103 kPa.

.2 Coupling to be grooved by stainless steel restraining teeth.

.3 Retaining ring to be made of 300 series stainless steel.

.4 Coupling gasket to be EPDM with a temperature range of -34˚C to 110˚C.

.5 Bolts and nuts to be zinc plated carbon steel (ASTM B633 ZN/FE5, finish Type II).

.2 Basis of Design: Victaulic Coupling Style 209.

2.6 Threaded Couplings

.1 Make screwed joints using American Standard threads to ANSI B1.20.1.

.2 Use Teflon tape as thread lubricant for threaded joints.

2.7 Flange Assembly Bolts

.1 Use hexagon head machine bolts with hexagon nuts for flange assembly bolts and all non-specialized bolts in the station.

.2 Bolt material: 300 series stainless steel, installed with anti-seize lubricant.

.3 Threads are to conform to CSA B.1.1 coarse thread series, Class 2 fit.

2.8 Conventional Flange Gaskets

.1 Provide die-cut conventional flange gaskets, with material consisting of aramid fibres in a nitrile elstomeric binder with a minimum continuous temperature rating of 2000C.

.2 Thickness: 1.6 mm (1/16") for flanges up to 600 mm.

.3 Thickness: 3.2 mm (1/8") for flanges larger than 600 mm.

.4 Solder will be lead free and conform to ASTM B32 and the NBC.

.5 Basis of Design: Garlock Multi-Swell 3760

2.9 Fittings

.1 Provide ductile iron fittings in PVC pipelines that conform to AWWA C110 or provide PVC to CSA B137.3, of the same material and class as the pipe.

.2 Provide copper fittings in copper pipelines conforming to ANSI B16.26.

.3 Provide eccentric reducers in horizontal lines with the flat side on top, unless shown otherwise on the drawings.

.4 Provide concentric reducers in vertical lines unless indicated otherwise.

PART 3 - EXECUTION

3.1	Preparation	.1	Prior to installation, inspect and field measure to ensure that previous work is not prejudicial to the proper installation of piping.
		.2	Make all minor modifications to suit installed equipment and structural element locations and elevations.
		.3	Piping arrangements indicated on the drawings have been established on the basis of the "Design Standard" listed in the specific process equipment sections. If the equipment to be provided is not the Design Standard, at no additional expense to the District, modify the piping arrangement as necessary.
3.2	Connections to Equipment	.1	In accordance with manufacturer's instructions unless otherwise indicated.
		.2	Use valves and either unions or flanges for isolation and ease of maintenance and assembly.
		.3	Unions are not required in installations using grooved mechanical couplings (the couplings will serve as unions).
		.4	Use double swing joints when equipment mounted on vibration isolation and when piping subject to movement.
		.5	The flexible type grooved joint couplings may be used in lieu of a flexible connector at equipment connections for vibration attenuation and stress relief. Place couplings in close proximity to the source of the vibration, as per manufacturer's recommendations.
3.3	Threaded Joints	.1	Conform to the requirement of ANSI B31.1.
		.2	Ream the end of all pipes to remove all burrs and cuttings when fabricating threaded joints.
		.3	Clean out pipe and repair linings and coatings prior to joining.
		.4	Apply Teflon tape to male threads and join pipe. Use both Teflon tape and Teflon sealing compound on stainless steel pipe threads. Do not use extra tape to make up for slack in the joint.
3.4	Flanged Joints	.1	Clean flanges and gaskets prior to connection.
		.2	Lubricate gaskets with soapy water and apply anti-seize compound to the bolts.

.3 Bring flanges into close parallel and lateral alignment.

.4 Tighten bolts progressively. Proceed from side to side of the flange.

.5 Bolt length shall be such that after the joints are made up the bolts shall protrude at least two threads past the nut, but not more than 12 mm.

.6 Washers may not be used to take up excess bolt length.

.7 Align flanges which connect piping to mechanical equipment to close parallel and lateral alignment prior to tightening bolts. Do not place undue strain on the equipment.

.8 Allow a minimum of 150 mm to face or 200 mm to edge of flange from wall, floor or ceiling unless otherwise shown.

3.5 Flanged Bolts

.1 Bolt length shall be such that after the joints are made up the bolts shall protrude at least two threads past the nut, but not more than 12 mm.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 This section describes the requirements for pipe identifications.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 22 11 16.01 – Piping Systems.

.3 Section 33 11 16 – Site Water Utility Distribution Piping.

PART 2 - PRODUCTS

2.12 Piping Colour Coding & Flow Direction

.1 Provide colour coding and flow direction on piping to show direction of flow. In general, identify all visible interior piping by the full name of the liquid (e.g.) "RAW WATER" and a direction of flow arrow as follows:

- .1 Every pipe between branches
- .2 Every 4 m of straight pipe

.2 Use the following piping identification colours:

- .1 Potable water – Light Blue
- .2 Raw water – Dark Blue
- .3 Backwash (Water Softener) Waste – Mid Brown
- .4 Drain – Light Grey
- .5 Sodium Hypochlorite – Primary Colour: Yellow, Secondary Colour: White/Red

PART 3 - EXECUTION

.1 Not Applicable

END OF SECTION

PART 1 - GENERAL

1.1 Summary
.1 Wafer type check valve to be provided after the flow meter and before the chlorine injection point, as shown on drawings.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures.
.2 Section 22 05 00.01 – Mechanical General Requirements
.3 Section 22 11 16.01 – Piping Systems

1.3 References
.1 NSF – Drinking Water System Components

1.4 Submittals
.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.4 Instructions: submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 Check Valves
.1 Provide Wafer Type, Flanged Check Valves, featuring:
1 Body to be PVC, disc spring to be made of hastelloy and seals are to be Viton.
.2 Minimum working pressure rating: 690 kPa.
.3 Required certification: NSF/ANSI Standard 61 Drinking Water System Components.
.4 Basis of Design: Chemline WP Series Wafer Check Valve.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions
.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Install where indicated in the process flow, as per the drawings.

.2 Install in accordance with manufacturer's instructions and as specified.

END OF SECTION

PART 1 - GENERAL

1.1 Summary
.1 Isolating ball valves to be installed in water treatment plant where indicated on drawings.

1.2 Related Sections
.1 Section 01 33 00 – Submittal Procedures.
.2 Section 22 05 00.01 – Mechanical General Requirements
.3 Section 22 11 16.01 – Piping Systems

1.3 References
.1 NSF – Drinking Water System Components

1.4 Submittals
.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.
.2 Product Data:
.1 Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
.3 Certificates: submit certificates signed by manufacturer certifying that materials comply with specified performance characteristics and physical properties.
.4 Instructions: submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 Ball Valves
.1 General:
.1 Type: Non-lubricated and capable of sealing in either flow direction.
.2 End connections: True union
.3 Rating: 1585 kPa rated with specified seat and seals.
.4 Provide safety stem design, blow-out proof with double O-rings.
.5 T-handle operator handle.
.6 Valves to be mounted so the valve position indicators are plainly visible when standing on the floor.
.2 Valves to be certification for NSF/ANSI Standard 61 Drinking Water System Components.

.3 Materials for Sodium Hypochlorite:

.1 Body and Ball to be made of PVC.

.2 Seat to be made of PTFE.

.3 O-rings to be made of Viton.

.4 Materials for Water:

.1 Body and Ball to be made of CPVC.

.2 Seat to be made of PTFE.

.3 O-rings to be made of EPDM.

.5 Basis of Design: Chemline Type 21 Ball Valves.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Install where indicated in the process flow, as per the drawings.

.2 Install in accordance with manufacturer's instructions and as specified.

.3 Ball valves with Viton o-rings are to be used the sodium hypochlorite injection system and piping. Ball valves with EPDM o-rings are no to be used with sodium hypochlorite.

END OF SECTION

PART 1 - GENERAL

1.1	Summary	.1	Appurtenances, including air release valves, pressure relief valve, and pressure gauges are to be installed as detailed on drawings.
		.2	Emergency shower, eyewash station and hot water tank to be located in proximity to the chlorine room, and plumbed and fit onsite.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 22 05 00.01 – Mechanical General Requirements
		.3	Section 22 11 16.01 – Piping Systems
1.3	References	.1	National Plumbing Code
		.2	ANSI Z358.1-2014 – Emergency Shower
		.3	CSA plumbing fixture standards
1.4	Submittals	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures.
		.2	Product Data: Submit manufacturer's printed product literature, specifications and datasheet for fixtures and equipment.
		.3	Instructions: submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1	Air Release Valves	.1	Provide an automatic air release valve designed to relieve air when under pressure.
		.2	Suitable for potable water service and fitted with inlet isolating ball valve.
		.3	Isolating valve and installation fittings to be PVC.
		.4	Air valve body to be Reinforced Nylon.
		.5	Inlet: 25 mm NPT.
		.6	Minimum working pressure: 1725 kPa (250 psig).
		.7	Basis of Design: ARI S-050.
		.8	Discharge to be piped to the floor.

2.2 Combination Air Release Valves

.1 Provide a compact combination automatic air release valve, designed to relieve vacuum or air when line filling or draining, plus accumulated air when under pressure

.2 Suitable for potable water service and fitted with inlet isolating ball valve.

.3 Isolating valve and installation fittings to be PVC.

.4 Air valve body to be Reinforced Nylon.

.5 Inlet: 50 mm NPT.

.6 Minimum working pressure: 1725 kPa (250 psig).

.7 Basis of Design: ARI D-040.

.8 Discharge to be piped to the floor.

2.3 Pressure Relief Valve

.1 Provide a direct acting spring loaded, diaphragm type relief valve with 25 mm threshed NPT inlet and outlet, 2758 kPa maximum inlet pressure and 138-517 kPa adjustment range, preset to 276 kPa no-flow.

.2 Material to be cast bronze UNS C87850.

.3 Basis of Design: 25 mm Cla-Val 55B-60.

2.4 Pressure Gauges

.1 Provide each gauge connection with a 15 mm lever operated isolating cock.

.2 Provide gauges that:

.1 Have a minimum 100mm dial.

.2 15 mm MNPT bottom connection of stainless steel or brass

.3 Dual scale psi and kPa readings.

.4 Have a range so the system operating pressure is approximately a 50% reading on the gauge (0-103 kPa – 0-15 psi).

.3 Isolating valve and installation fittings are to be PVC and utilize hex nipples, not close type.

.4 Basis of Design: USG 656-6C, ENFM 7211, Wika 213.53, Winters LF, NuovaFima 18/3-A4.

2.5 Emergency Shower and Eyewash

.1 Provide a free standing combination emergency drench shower with a 25 mm ball valve, stainless steel shower head, stainless steel facewash bowl, 737 mm long pull rod and hand operated eye wash. Valve on Shower to remain open until manually closed.

.2 Combination emergency drench shower to be ANSI Standard Z358.1-2014.

.3 Discharge water temperature of combination emergency drench shower to be between 27˚C and 29˚C.

.1 Basis of Design: Guardian G1996.

.4 Provide a thermostatic mixing valve to provide a tempered water supply to both the eye wash and the shower.

.1 Basis of Design: Guardian model TMV G3800.

.5 Provide a flow regulator to regulate shower flow rate to 20 GPM.

.1 Basis of Design: Guardian model FC20.

.6 Provide a single pole, double throw flow switch to provide flow indication.

.1 Basis of Design: Guardian model AP275-615.

.7 Provide a test kit to include:

.1 Minimum 18-liter plastic bucket

.2 2 meter foot long watertight 45-liter translucent vinyl plastic bag for attaching over drench showerhead.

.1 Bag is to be hemmed at bottom and have a drawstring top.

.3 Testing record card.

.4 Basis of Design: Guardian model AP250-005.

2.6 Hot Water Tank

.1 Provide two 246 litre hot water tanks. The tanks are to have two 3000 watt elements, non-simultaneous operation, 208 V, three phase.

.2 Tanks to be supplied with a temperature and pressure relief valve and a drip pan with drain to floor. Hot water tank to be located in proximity to the Emergency Shower and Eyewash.

.3 Temperature and pressure relief valve to be piped to closest floor drain.

.4 Hot water tanks to be set for 70˚ Celsius.

.5 Basis of Design: Bradford White Model M-2-65S6DS, energy saver electric water heater.

2.7 Hot Water Expansion Tank

.1 Provide a hot water expansion tank with a gross volume of 8 L, butyl rubber diaphragm, 25 mm bottom connection, maximum working pressure of 1035 kPa, maximum temperature of 93˚ Celsius and pre-charged to 276 kPa.

.2 Basis of Design: Elbi of America Model DXT-08.

PART 3 - EXECUTION

3.1 Manufacturer's Instructions

.1 Compliance: Comply with manufacturer's written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Install equipment in accordance with manufacturer's instructions and as specified.

.2 Air release valves and pressure gauges: install where indicated in the process flow, as per the drawings.

.3 Emergency Shower and Eyewash, comes with thermostatic mixing valve and hot water tank(s):

.1 Drawings show a preliminary location for the shower and hot water tanks. The Contractor is to confirm the location and field fit the shower on-site to the satisfaction of the Departmental Representative. Location shall comply with ANSI Standard Z358.1-2014.

.2 Drainage water is to be collected and piped to drain.

.3 Provide and install adequate water supply to hot water tank and associated connection with the thermostatic mixing valve and shower/eyewash that meets approval of the Departmental Representative.

.4 Drench shower to be installed in accordance with ANSI Z358.1-2014 requirements and manufacturer's instructions.

3.3 Testing

.1 After completion of installation, provide testing to demonstrate compliance with the operating and performance requirements as specified in Section 01 91 00 General Commissioning Requirements.

END OF SECTION

PART 1 - GENERAL

1.1 Scope	.1	This specification outlines requirements for seismic restraint and anchorage, relating to all structures, tankage, mechanical equipment, electrical equipment and piping.
1.2 Related Sections	.1	Section 01 33 00 – Submittal Procedures.
	.2	Section 22 05 00.01 – Mechanical General Requirements
1.3 References	.1	National Building Code 2015 and BC Building Code 2012, follow whichever is more stringent.
1.4 Submittals	.1	Submit the following information: .1 The Contractor and/or his Suppliers shall retain a seismic engineer registered in British Columbia to certify that all non-structural components are designed and installed as per NBC requirements, design, submit plans and review the construction of all seismic restraint systems required, an complete and seal the "Confirmation of Professional Assurance of Design and Field Review" those Items.
1.5 Design Criteria and Installation	.1	"Post-Disaster" buildings as classified as per Article 1.4.1.2 and Table 4.1.2.1 of the National Building Code (NBC), is subject to the requirements of the Nation Building Code Division B Part 3.
	.2	All structures, tankage, mechanical equipment, and electrical equipment listed in Table 4.1.8.18, shall be provided with seismic restraint and anchorage as per Section 4.1.8.18.
	.3	Contractors is to design, supply and install all pipe supports and anchors.

PART 2 - PRODUCTS NOT APPLICABLE

PART 3 - EXECUTION NOT APPLICABLE

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 This specification details anchor bolt requirements for all equipment, machinery, and structural supports. All anchor bolts are to be cast-in-place. Substitution will only be acceptable if approved by the Departmental Representative.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 03 30 00 – Cast-in-Place Concrete.

1.3 References

.1 CSA/CAN

.2 National Building Code 2015 and BC Building Code 2012, follow whichever is more stringent.

1.4 Submittals

.1 Product Data - Submit the following product information for review, in accordance with Section 01 33 00 Submittal Procedures, for all bolt systems not cast-in-place:

.1 Data, indicating load capacities and embedment requirements.

.2 Chemical resistance.

.3 Temperature limitations

.4 Installation instructions.

.2 Submit samples to the Departmental Representative of proposed adhesive and expansion type anchors.

.3 Shop Drawings - Submit shop drawings for information only, in accordance with Section 01 33 00 Submittal Procedures, clearly indicating anchor bolt type, diameter, minimum embedment length, location, materials, projection, plates, washers, nuts, sleeves and torque requirements of anchor bolts to be used. Shop drawings are to bear the seal of a professional engineer registered in British Columbia.

1.5 Quality Control

.1 Arrange a field demonstration of correct installation procedures with bolt manufacturer, for all adhesive and expansion anchors. Notify Departmental Representative a minimum of 48 hours in advance of the demonstration.

.2 Pull out tests will be carried out by the Contractor at a Testing Laboratory approved by the Departmental Representative. Pull out tests must be performed prior to the use of the anchors on site.

PART 2 - PRODUCTS

2.1 Materials

.1 Select anchor bolt material according to exposure conditions:

.1 External applications or areas exposed to outside air: Stainless steel to AISI Type 316.

.2 Internal applications: Stainless steel to AISI Type 304.

.3 Permanently or intermittently submerged: stainless steel to AISI Type 316.

.4 Anchor bolts securing proprietary equipment: in accordance with the requirements of Division 11.

.2 Nuts and washers to be of same material and of equal or greater strength than bolts. Tapered washers to be provided where mating surface not square with nut.

2.2 Delivery, Storage and Handling

.1 Deliver, store, handle and protect materials in accordance with manufacturer's instructions.

2.3 Typical Products

.1 Adhesive anchor bolts basis of deisgn: Hilti HIT-HY200, HVA adhesive anchors.

.2 Expansion anchor bolts will not be permitted unless approved by the Departmental Representative.

2.4 Design Criteria

.1 Design bolt sizing and spacing to CSA/CAN3-S16.1; CAN3-A23.3.

.2 Design anchor bolts with due regard for edge distances, bolt spacing and available embedment depth.

.3 All anchor bolts to be cast-in-place. No substitution will be permitted unless approved by the Departmental Representative and equipment manufacturer.

PART 3 - EXECUTION

3.1 General

.1 Anchor bolt holes in support frames not to exceed bolt diameter by more than 25 percent, up to a limiting maximum oversizing of 12 mm.

.2 Minimum anchor bolt diameter 12 mm.

.3 Do not use adhesive anchors in overhead applications.

.4 Adhesive and expansion anchor bolt locations to be reviewed by the Departmental Representative prior to use or installation.

.5 Field work, including cutting and threading, will not be permitted on galvanized items. Protect dissimilar metals from galvanic corrosion by means of pressure tapes, coatings or isolators. Grout anchor bolts with non-shrink grout, where specified, in accordance with manufacturer's recommendations.

.6 Provide equipment anchor bolts with sleeves to allow fine adjustment in place. Sleeves must not reduce the capacity of the anchor bolt.

3.2 Installation of Cast in Place Anchor Bolts

.1 Cast-in-place anchor bolts to be accurately placed and securely held in position with a template prior to and during concrete placement. Install anchor bolts complete with washers and sleeves where specified. Protect bolt threads with grease and attach nuts.

3.3 Installation of Adhesive & Expansion Anchor Bolts

.1 Limit use to locations where exposure to the following on an intermittent or continuous basis is extremely unlikely:

.1 Acid concentrations greater than 10 percent.

.2 Chlorine gas.

.3 Machine or diesel oils.

.4 Fire.

.5 Concrete or rod temperatures above 48°C.

.2 Adhesive anchor to be threaded or deformed for full length of embedment. Holes to be free of rust, scale, grease and oils. Embedment length as specified or to manufacturer's recommendations.

.3 Install anchor bolts in strict accordance with manufacturer's specifications and recommendations including maximum hole diameter.

.4 Holes to have rough surfaces, such as can be achieved using a rotary percussion drill. Locate reinforcement using non-destructive method prior to drilling.

.5 Blow clean holes with compressed air to remove dust and standing water prior to installation.

.6 Leave adhesive anchors undisturbed and unloaded for the entire curing period. Replace anchors which have been disturbed or loaded during the adhesive curing period at Contractor's expense. Concrete temperature (not air temperature) to be compatible with manufacturer's curing requirements.

.7 Anchor sizing requires a minimum factor of safety of 4 to 1 (allowable load vs actual load).

.8 Expansion anchor bolts to be free of rust, scale, grease and oils.

END OF SECTION

PART 1 - GENERAL

1.1 Summary

.1 Supply and installation of permanent identification nameplates, labels and markers for mechanical and HVAC equipment, pipework, valves and analytical monitoring.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

1.3 References

.1 N/A

1.4 Submittals

.1 Submittals in accordance with Section 01 33 00 - Submittal Procedures.

.2 Submit a typed nameplate schedule for all mechanical, HVAC, and analytical monitoring equipment before operational testing.

.3 Submit a marker/legend schedule for mechanical pipework identified on process flow drawings.

.4 Incorporate nameplate and marker/legend schedules into the Operations and Maintenance Manuals.

PART 2 - PRODUCTS

2.1 Nameplates

.1 Provide nameplates for equipment having a standard equipment number including electrical and mechanical equipment, process instruments, and control valves.

.2 Provide nameplates with the following characteristics:

.1 Manufacture nameplates from 3 ply lamacoid, minimum 1.6 mm thick with 0.9 mm chamfered edges, engraved lettering and matte finish.

.2 Use capitalized lettering centred on each row and in Gothic font.

.3 Use self-adhesive backing filling the entire area of the back for nameplates except where insufficient area exists to reliably affix a nameplate. For nameplates without self-adhesive backing provide nameplate with 5 mm diameter tie hole.

.3 Where a nameplate cannot be reliably placed on equipment or instruments using self-adhesive backing, use a nylon tie to fasten

nameplate. For this application provide a nameplate without self-adhesive backing and a 5 mm diameter tie hole.

.4 Where exposed to wet or corrosive areas, fasten the nameplate with stainless steel self-tapping Robertson screws.

.5 Do not use embossed plastic labels.

.6 Colour coding:

.1 General Purpose – white face, black lettering (outer two plys white, inner ply black).

.2 Warning Messages – yellow face, black lettering (outer two plys yellow, inner ply black).

.3 Others – as specified or shown.

2.2 Markers

.1 Identify material contained in above ground mechanical piping system using plastic background colour marking and legend system. Apply intermittent markings on straight pipe runs, close to all valve, fittings or junction boxes and adjacent to all changed in direction or where pipes pass through walls or floors. Minimum length of markings is 250 mm.

.2 For above ground pipework mechanically attached type background colour markers that are easily removable; adhesive type markers are not acceptable. For underground pipework provide stretchable polyethylene ribbon or detectable ribbon laid a minimum of 150 mm above the buried pipe.

.3 Provide identification marking material which has good weathering, moisture and wrinkling resistance.

.4 Marker/Legend Colour Coding:

Material	Legend Colour
Potable Water	Light Blue
Raw Water	Dark Blue
Drain	Light Grey
Sodium Hypochlorite	Primary Colour: Yellow Secondary Colour: White/Red

.5 Legend

.1 Identify material contained in piping system by a legend made up of clearly legible letters. Place legend on background colour marker in accordance with colour coding.

.2 Provide direction arrows for flow. Arrow code is the same as legend colour code.

.3 Legend sizing:

Pipe or Covering OD, mm	Legend Size, mm
>20-30	15
>30-50	20
>50-150	30
>150-250	60
>250	90

.2 For pipes less than 20 mm diameter, use tags or wall markings with legend size of 15 mm.

.6 Visibility

.1 Place identification on the bottom of the piping system for pipe systems located near ceiling or above an employee's line of sight.

.2 Place identification on the side of the piping systems for pipe systems located approximately at employee's line of sight or below.

.3 Place identification approximately at employee's line of sight for vertical pipe systems.

PART 3 - EXECUTION

3.1 General

.1 Affix nameplates, where possible, to an area of the piece of equipment that would remain fixed if for example the piece of equipment is removed for maintenance. Examples:

.1 Mount the nameplates for pumps and motors on the base plate.

.2 Hand the nameplate for an inline pump by a nylon tie near the electrical connection at the pump.

.2 Install nameplates, labels and markers prior to operational testing.

3.2 Testing

.1 Perform performance tests and test all control function and make and adjustments or corrections required.

.2 Provide Suppliers field test report including certification of correct equipment operation.

END OF SECTION

PART 1 - GENERAL

1.1	Summary	.1	Motorized damper and damper actuator to be provide in the Chlorination room for ventilation.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 01 91 00 – General Commissioning Requirements.
		.3	Section 01 91 01 – Equipment and System Performance and Operational Testing.
		.3	Division 26 – Electrical.
1.3	References	.1	NFPA 90A, Installation of Air Conditioning and Ventilation Systems
		.2	NFPA 90B, Installation of Warm Air Heating and Air Conditioning Systems.
		.3	SMACNA HVAC Duct Construction Standards, Metal ad Flexible
1.4	Submittals	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures.
		.2	Indicate the following:
			.1 Motorized dampers.
			.2 Actuators - electric.

PART 2 - PRODUCTS

2.1	General	.1	Manufacture in accordance with SMACNA – HVAC Duct Construction Standards.
2.2	Motorized Control Damper	.1	Parallel or opposite blade type as below:
			.1 Modulating dampers: Opposed blade type.
			.2 Two-position shutoff dampers: parallel or opposed blade type with blade and side seals.
		.2	Damper frames: built to the structural equivalent of 13 gauge steel channel and galvanized or extruded aluminium with reinforced corner bracing.
		.3	Damper blades :
			.1 Not to exceed 200 mm in width or 1200 mm in length.

.2 Blades are to be suitable for medium velocity performance (600 m/min).

.3 Blades not less than 16 gauge.

.4 Damper blade shall be installed on a steel shaft operating in synthetic bearings suitable for industrial service.

.4 Seals :

.1 All blade edges and top and bottom of the frame provided with replaceable EPDM, or silicone.

.2 Blade seals to provide for a maximum leakage rate of 180 $m^3/hr/m^2$ at 100 mm w.c. differential pressure.

.3 Pressure drop not to exceed 2.54 mm w.c. at a wide open face velocity of 7.62 m/s.

.5 Damper sections not to be larger than 1200 mm x 1500 mm. Provide a minimum of one damper actuator per section.

.6 Modulating dampers: Provide a linear flow characteristics where possible.

.7 Damper to have a protective coating identical to the coating applied to the connected ductwork and equipment.

.8 Thermally insulated damper to have an insulating factor of R-2.29 or higher.

2.3 Damper Actuator

.1 On/Off Spring Return Type

.1 On/Off spring return damper actuators shall be direct coupled type which require no crankarm and linkage and be capable of direct mounting to a jackshaft up to a 26.67 mm diameter.

.2 Actuators to have a manual positioning mechanism accessible on its cover. Actuators to use a brushless DC motor and be protected from overload at all angles of rotation. Run time shall be constant and independent of torque.

.3 If required, 2 SPDT auxiliary switches shall be provided with one switch having the capability of being adjustable. Actuators must be constructed to meet the requirement for Double Insulation so an electrical ground connection is not required to meet agency listings.

.4 Ambient temperature range at least 4˚C to 50˚C, expect actuators subjected to outdoor ambient to have ambient range of -30˚C to 50˚C minimum.

.5 Actuators to be UL Approved and CSA certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards.

.6 Furnish a separate actuator for each damper section.

.7 Basis of design for actuators: Belimo, Honeywell, or Johnson Control

.2 Modulating Type

.1 Spring return control damper actuators to be direct coupled type which require no crankarm and linkage and capable of direct mounting to a jackshaft up to a 26.67 mm diameter.

.2 The actuator must provide proportional damper control in response to a 4 to 20 mA control input from an electronic controller or positioner.

.3 The actuators must be designed so that they may be used for either clockwise or counter-clockwise fail-safe operation. Actuators shall have control direction of rotation switch accessible on its cover.

.4 Actuators to use a brushless DC motor controlled by a microprocessor and be protected from overload at all angles of rotation. Run time shall be constant, and independent of torque.

.5 Ambient temperature range at least 4˚C to 50˚C, expect actuators subjected to outdoor ambient to have ambient range of -30˚C to 50˚C minimum.

.6 Actuators to be UL Approved and CSA certified, have a 5 year warranty, and be manufactured under ISO 9001 International Quality Control Standards.

.7 Furnish a separate actuator for each damper section.

.8 Actuators to be manufactured .... Belimo, Honeywell, or johnson control.

PART 3 - EXECUTION

3.1 Installation

.1 Install duct accessories according to applicable details in SMACNA's "HVAC Duct Construction Standards-Metal and Flexible" for metal ducts.

.2 Provide duct accessories of materials suited to duct materials; use aluminium accessories in aluminium ducts, and stainless steel accessories in stainless steel ducts.

.3 Flexible connections:

.1 Install in following locations:

- Inlets and outlets of supply air units and fans
- Inlets and outlets of exhaust and return air fans
- As indicated on drawings

END OF SECTION

PART 1 - GENERAL

1.1	Summary	.1	Supply, installation, testing and commissioning of the chlorine room exhaust fan.
1.2	Related Sections	.1	Section 01 33 00 – Submittal Procedures.
		.2	Section 22 05 00.01 – Mechanical General Requirements
		.3	Section 26 05 00 – Common Work Results - Electrical
1.3	References	.1	ACMA 210, Laboratory Methods for the testing of Fans
		.2	ACMA 300, Reverberant Room Method for Sound Testing of Fans
		.3	ACMA 330, Laboratory Method of Testing In-duct Sound Measurement for Fans
		.4	AMCA 99-0401, Spark Resistant Construction
		.5	CSA C22.2 No. 113, Fans and Ventilators
1.4	Submittals	.1	Submittals in accordance with Section 01 33 00 - Submittal Procedures.
		.2	Product Data: Submit Suppliers printed product literature, specifications and datasheet for fixtures and equipment.
		.3	Instructions: submit Suppliers installation instructions.
		.4	Provide Fan performance curves of capacity versus static pressure, break horsepower versus capacity.
		.5	Provide a curve of noise sound power level values at rated RPM.
		.6	Provide motor data and wiring diagrams.
1.5	Quality Assurance	.1	Supplier of the ventilating equipment is to have designed and installed equipment of the type detailed in the specification and of compatible capacity.
		.2	Supplier to have equipment installed in similar environments for a minimum of 3 years with minimal downtime.

PART 2 - PRODUCTS

2.1	Inline Exhaust Fan	.1	Provide an exhaust inline fan of the centrifugal, direct driven type.

.2 Fan to have 62.9 m^3/h and to be put on a timer to operate for 4 minutes every 30 minutes. In addition to the timer the fan is to be put on a manual switch that is located outside of the chlorine room.

.3 Fan housing to be constructed of UV resistant, flame retardant Polycarbonate (PC) thermos plastic.

.4 Fan to be supplied with an integral external electrical terminal box with prewired terminal strip connections.

.5 Capacitor to be provided and located within the fan electrical terminal box for easy access.

.6 Motorized impeller to be of the external rotor type, class B insulation, totally enclosed PSC Type for maximum efficiency.

.7 Motor to be permanently sealed self-lubricating ball bearing type. It is to be equipped with automatic reset thermal overload protection and be acceptable for continuous duty.

.8 Fan wheel to be of the backward inclined centrifugal type with a inlet venture for maximum performance.

.9 The motorized impeller is to be statically and dynamically balanced as one integral unit to provide for vibration free performance.

.10 Fain air flow performance shall be certified by HVI and licensed to bear the HVI Tested/Certified Performance Logo.

.11 Fan to be tested and approved by UL and CSA for safety.

.12 Basis of Design: Fantech FR100

PART 3 - EXECUTION

3.1 Supplier's Instructions

.1 Compliance: Comply with suppliers written recommendations or specifications, including product technical bulletins, handling, storage and installation instructions, and data sheet.

3.2 Installation

.1 Install and initiate operation or equipment according to the supplier's instructions.

.2 Locate unit approximately where shown to provide access space required for motor, drive and bearing servicing and fan shaft and coil removal.

3.3 Cleaning	.1	On completion of installation, internally clean fans according to Suppliers written instructions. Remove foreign material and construction debris. Vacuum fan wheel and cabinet.
	.2	Inspect exposed finish. Remove burrs, dirt and construction debris and repair damaged finishes.
3.3 Testing	.1	Perform performance tests and test all control function and make and adjustments or corrections required.
	.2	Provide Suppliers field test report including certification of correct equipment operation.

END OF SECTION

PART 1 - GENERAL

1.1 Scope

.1 This specification details the louvre for the chlorine room exhaust fan.

1.2 Related Sections

.1 Section 01 33 00 – Submittal Procedures.

.2 Section 23 34 00 – Fans.

1.3 References

.1 ASTM

.1 E90 – Method for Laboratory Measurement of Air borne Sound Transmission Loss of Building Partitions and Elements.

.2 Air Movement and Control Association

.2 500-L – Laboratory Methods of Testing Air Louvres for Rating.

1.4 Submittals

.1 Product Data - Submit the following product information for review, in accordance with Section 01 33 00 Submittal Procedures.

.1 Pressure drop

.2 Face area

.3 Free area

.4 Dimension

.5 Material

.6 Colour and finish

1.5 Quality Control

.1 Catalogued or published ratings to be obtained from testes carried out by manufacturer or those ordered by the manufacturer from independent testing agency signifying adherence to codes and standards.

.2 Tested in accordance with AMCA Standard 500 and to bear the AMCA Certified Ratings Seal for both air performance and water penetration.

.3 Submit certified data from independent laboratory substantiating acoustic and aerodynamic performance to ASTM E90

1.6 Delivery, Storage and Handling

.1 Deliver, store, handle and protect materials in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1	Materials	.1	Extruded aluminium alloy 6063-T5.
2.2	Fixed Drainable Louvre	.1	Louvre to bear AMCA Seal.
		.2	Construction to be welded with exposed joints ground flush and smooth.
		.3	Blade to be of a stormproof pattern with centre watershed in blade, reinforcing bosses and maximum blade length of 1500 mm.
		.4	Frame, head, sill and jamb to be 100 mm deep one piece extruded aluminium, minimum 3 mm thick with approved caulking slot, integral to unit.
		.5	Unless otherwise indicated screens are to be 15mm, 2mm diameter wire mesh, aluminium birdscreen on inside face of louvres in formed U-frame.
		.6	Louvre finishing to be full strength, 70%, Kynar 500, AAMA 2605.
		.7	Colour to match existing.
		.8	Basis of design: Ruskin ELF375DXH drainable stationary louver.

PART 3 - EXECUTION

3.1	Installation	.1	Louvres to be installed per architectural details and/or the manufacturer's recommendations.
		.2	Frames caulked weather-tight to the structure using materials approved by the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

.1 Section 26 05 00 refers to those portions of the work that are unique to electrical systems. This section must be referenced to and interpreted simultaneously with all other sections pertinent to the works described herein.

.2 Ensure all completed work is free of short circuits and unspecified grounds and operates properly to the satisfaction of the Departmental Representative.

.3 The Contractor will be responsible for the safekeeping of all Departmental Representative supplied material and equipment at the jobsite and shall provide adequate storage facilities protected from the environment.

.4 Inspect, test, megger, clean, adjust and calibrate equipment and services as required to provide a working installation prior to energizing as specified by the Departmental Representative or manufacturer, to the approval of the Departmental Representative.

.5 Complete all works in a neat and tidy fashion satisfactory to the Departmental Representative.

.6 Advise Departmental Representative immediately of any design deficiencies or discrepancies.

.7 All electrical work shall be performed by an Electrical Contractor currently registered under the provisions of the Electrical Safety Act of British Columbia.

.8 Prior to commencing construction the Contractor shall name at least one (1) registered representative whose qualifications shall comply with the Electrical Safety Act of British Columbia who shall be responsible for the project.

.9 Place "Hold" tags on all electrical and control systems, tagging out power to the panels and racks, as required to protect the work from damage which could result from premature use.

.10 A Workers Compensation Board Form 30 M 33 must be completed prior to working in the vicinity of overhead powerlines.

.11 The electrical drawings and specifications are based on the use of Grundfos-brand pumps (5 hp, 6.9 FLA @ 575VAC, 3-phase). Contact the Departmental Representative immediately if the actual pumps utilized are a different make, model number or operating characteristics as the electrical requirements may be subject to change

.12 The Contractor shall familiarize himself with all building plans including those of all subtrades, and arrange his equipment with due regard to all architectural, structural and mechanical fixtures. The architectural, structural and mechanical plans shall be consulted for final locations of walls, doors, equipment, etc.

.13 The plans show approximate locations of outlets and apparatus but the right is reserved to make such changes in locations as may be necessary to meet the exigencies of construction in any way. No extra will be allowed for such changes to any piece of electrical equipment or apparatus unless the distance moved exceeds 3 metres.

.14 Allowance has been made in the design for the size and number of conductors and embedded conduits which is considered adequate for serving the various drives and equipment. These conductors and conduits are based on available data pertaining to a particular design of equipment. If the Contractor provides equipment which differs in connection requirements from the equipment shown, the acceptance of the substitution shall not relieve the Contractor of his obligation to provide the necessary diagrams, services, materials and connections to the equipment as part of the work.

1.2 Scope of Work

.1 The Contractor shall supply all wiring and equipment necessary to complete properly operating systems as specified herein and as shown on the drawings, unless otherwise indicated. All materials, labour, tools and appliances necessary for the work shall be furnished by the Contractor.

.2 The determination and delineation of responsibilities for equipment supply and installation between the general contractor, mechanical contractor, electrical contractor and other contractors shall be the responsibility of the general contractor.

.3 The electrical work for the water treatment plant shall include, but shall not be limited to:

.1 Supply and install all electrical distribution equipment and associated cables, conduit and wiring as shown on the drawings, including but not limited to:

.1 600V splitter

.2 600V circuit breakers

.3 120/208V branch circuit breakers in existing panelboard 'A'

.4 VFDs, and dV/dt output filters inside filter cabinet

.2 Supply and install underground conduits, cables and wiring including trenching, bedding material, warning tape and backfill.

.3 Supply and install the well pumps control panel as shown on the drawings, including but not limited to:

- .1 Enclosure
- .2 DC power supply
- .3 Control relays
- .4 Loop isolators
- .5 Signal protectors
- .6 Pushbuttons, indicating lights, selector switches, potentiometers, elapsed time meters
- .7 RTU
- .8 Circuit breakers
- .9 Terminal blocks
- .10 Wire duct & wiring
- .11 Lamacoid nameplates

.4 Supply and install field instruments, process control equipment and associated cables, conduit and wiring, including but not limited to the following:

- .1 Magnetic flow transmitter
- .2 Hypochlorite metering pumps (supplied and installed by mechanical, connected by electrical)
- .3 Turbidity analyzer (supplied and installed by mechanical, connected by electrical)
- .4 Junction boxes, local disconnect switches and submersible pressure transmitters (with aneroid bellows and signal protectors) at Wells #1 & #2
- .5 Emergency shower flow switch (supplied and installed by mechanical, connected by electrical)
- .6 Heat tracing complete with controller

.5 Supply and install timer switch, timing relays, control relay, power relay, and junction box for chlorination room exhaust fan. Connect exhaust fan & motorized damper (supplied and installed by Mechanical).

.6 Connect hot water tanks (supplied and installed by Mechanical).

.7 Supply and install lighting fixtures and lamps.

.8 Supply and install all branch circuit cables, conduit and wiring for power, data communications, heating, ventilating and lighting, including wall switches, receptacles, cover plates, selector switches, pushbuttons, etc.

.9 Connect new pumps at Wells #1 & #2.

.10 Connect new UV Control panels #1 & #2 and UV reactors.

1.3 Work by Others

.1 The RTU, HMI, SCADA computer will be programmed by others.

.2 The VFDs and flow transmitter will be programmed by the Departmental Representative.

1.4 Codes and Standards

.1 Perform complete installation in accordance with the latest version of the BC Electrical Safety Act, the Canadian Electrical Code and any local bylaws or rules regulating the installation of electrical equipment.

.2 Install overhead and underground systems in accordance with CSA C22.3 No. 1-M87 and CSA C22.3 No. 7-94 except where specified otherwise.

1.5 Care, Operation and Start-up

.1 Instruct operating personnel in the operation, care and maintenance of equipment.

.2 Provide these services for such period, and for as many visits as necessary to put equipment in operation, and ensure that operating personnel are conversant with all aspects of its care and operation.

1.6 Permits, Fees and Inspection

.1 Submit to Electrical Inspection Department and Supply Authority necessary number of drawings and specifications for examination and approval prior to commencement of work.

.2 Pay associated fees.

.3 Departmental Representative will provide drawings and specifications required by Electrical Inspection Department and Supply Authority at no cost.

.4 Notify Departmental Representative of changes required by Electrical Inspection Department prior to making changes.

.5 Furnish Certificates of Acceptance from Electrical Inspection Department on completion of work to Departmental Representative.

1.7 Materials and Equipment

.1 Supply equipment exactly as indicated by the drawings and specifications. Other materials may be substituted by the Contractor provided only that

such substitutions have been approved by the Departmental Representative prior to installation.

.2 All equipment and materials shall be new and shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.

.3 Factory-assemble control panels and component assemblies. Finished control panels and component assemblies shall bear a certification mark (CSA, ULc, ETL, etc.) that is acceptable to the BC Safety Authority.

.4 Shop drawings shall be submitted for the following (at minimum):

- .1 Control panel
- .2 Flow transmitter
- .3 VFDs

.5 When submitting shop drawings, the Contractor shall notify the Departmental Representative in writing of changes made therein from the electrical drawings and specifications.

.6 Shop drawings returned marked "Revise and Resubmit for Review" shall be appropriately corrected and resubmitted within 10 days.

.7 The review of shop drawings by the Departmental Representative is for the sole purpose of ascertaining conformance with the general design concept, but no approval is given or responsibility assumed by the Departmental Representative for the detailed design inherent in the shop drawings or for corrections of dimensions or details or conformity to specifications, which remain the responsibility of the Contractor and the Supplier.

1.8 Maintenance Manuals

.1 The Contractor shall furnish the Departmental Representative with three complete bound sets of typewritten or printed instructions, covering the proper method of maintaining and operating all the systems included in this contract.

.2 The manuals shall also include all shop drawings, catalogue numbers of all electrical equipment installed and manufacturer's parts lists.

.3 The Contractor shall include manufacturer's O&M manuals, drawings and installation leaflets for every piece of electrical/instrumentation equipment.

1.9 Voltage Ratings

.1 Operating voltages to CAN3-C235-83.

.2 Motors, electric heating, control and distribution devices and equipment to operate satisfactorily at 60 Hz within normal operating limits

established by above standard. Equipment to operate in extreme operating conditions established in above standard without damage to equipment.

1.10 Finishes

.1 Shop finish metal enclosure surfaces inside and outside by application of 2.0-3.0 mils of zinc-rich primer powder coat, followed by 3.0-4.0 mils of powder top coat. The finish shall be free of thickness variations, poor adhesion, "orange peel", blistering, pinholes, craters, powder puffs, drips, color variations, clouding or grainy/wavy flow. Primer coat shall be Tiger Drylac #69/90350 or equal. Top coat shall be Tiger Drylac – Series 38 or equal.

.1 Outdoor electrical equipment shall be RAL #6005 "Moss Green" color

.2 Indoor switchgear and distribution enclosures shall be ASA #61 grey.

.2 Clean and touch up surfaces of shop-painted equipment scratched or marred during shipment or installation, to match original finish.

.3 Clean and prime exposed non-galvanized hangers, racks and fastenings to prevent rusting.

1.11 Equipment Identification

.1 Identify electrical equipment with nameplates as follows: Lamacoid 3 mm thick plastic engraving sheet, white face, black core, mechanically attached with self tapping screws. See drawings for details.

.2 Wording on nameplates to be as shown on drawings.

.3 Identification to be English.

.4 Nameplates for terminal cabinets and junction boxes to indicate system and/or voltage characteristics.

.5 Disconnects, starters and contactors: indicate equipment being controlled and voltage.

.6 Terminal cabinets and pull boxes: indicate system and voltage.

.7 Transformers: indicate capacity, primary and secondary voltages.

1.12 Wiring Identification

.1 Identify wiring with permanent indelible identifying markings, either numbered or coloured plastic tapes, on both ends of phase conductors of feeders and branch circuit wiring.

.2 Maintain phase sequence and colour coding throughout.

.3 Colour code: to CSA C22.1.

.4 Use colour coded wires in communication cables, matched throughout system.

1.13 Wiring Termination

.1 Lugs, terminals, screws used for termination of wiring to be suitable for either copper or aluminium conductors.

1.14 Manufacturers and CSA Labels

.1 Visible and legible after equipment is installed.

1.15 Warning Signs

.1 As specified and to meet requirements of the BC Electrical Safety Act, the Electrical Inspection Department and the Departmental Representative.

.2 Decal signs, minimum size 175 x 250 mm.

1.16 Location of Outlets

.1 Locate outlets as shown on the drawings.

.2 Do not install outlets back-to-back in wall; allow minimum 150 mm horizontal clearance between boxes.

.3 Change location of outlets at no extra cost or credit, providing distance does not exceed 3000 mm, and information is given before installation.

.4 Locate light switches on latch side of doors.

1.17 Mounting Heights

.1 Mounting height of equipment is from finished floor to centreline of equipment unless specified or indicated otherwise.

.2 If mounting height of equipment is not specified or indicated, verify before proceeding with installation.

.3 Install electrical equipment at following heights unless indicated otherwise.

.1 Local switches: 1400 mm.

.2 Wall receptacles:

.1 General: 300 mm.

.2 Above top of continuous baseboard heater: 200 mm.

.3 Above top of counters or counter splash backs: 175 mm.

.4 In mechanical rooms: 1400 mm.

.3 Panelboards: as required by Code or as indicated.

.4 Telephone and interphone outlets: 300 mm.
.5 Wall mounted telephone and interphone outlets: 1500 mm.
.6 Fire alarm stations: 1500 mm.
.7 Fire alarm bells: 2100 mm.
.8 Television outlets: 300 mm.
.9 Wall mounted speakers: 2100 mm.
.10 Clocks: 2100 mm.
.11 Door bell pushbuttons: 1500 mm.

1.18 Load Balance

.1 Measure phase current to panelboards with normal loads (lighting) operating at time of acceptance. Adjust branch circuit connections as required to obtain best balance of current between phases and record changes.

1.19 Conduit and Cable Installation

.1 Install conduit and sleeves prior to pouring of concrete. Sleeves through concrete: plastic, sized for free passage of conduit, and protruding 50 mm.

.2 If plastic sleeves are used in fire rated walls or floors, remove before conduit installation.

.3 Install cables, conduits and fittings to be embedded or plastered over, neatly and close to building structure so furring can be kept to minimum.

1.20 Field Quality Control

.1 Conduct tests of the following equipment:
.1 Power distribution system including phasing, voltage, grounding and load balancing.
.2 Circuits originating from branch distribution panels.
.3 Lighting and its control.
.4 Motors, heaters and associated control equipment including sequenced operation of systems where applicable.
.5 Process control and instrumentation systems.

.2 Insulation resistance testing:
.1 Megger circuits, feeders and equipment up to 350 V with a 500 V instrument.
.2 Megger 350-600 V circuits, feeders and equipment with a 1000 V instrument.

.3 Check resistance to ground before energizing.

.4 Carry out tests in presence of Departmental Representative.

	.5	Provide instruments, meters, equipment and personnel required to conduct tests during and at conclusion of project.
	.6	Submit test results for Departmental Representative's review.
1.21 Coordination of Protective Devices	.1	Ensure circuit protective devices such as overcurrent trips, relays and fuses are installed to required values and settings.
1.22 Storage of Electrical Equipment	.1	All equipment shall be adequately protected from damage and from dust, dampness or any other injurious substance during delivery to the site, while stored at the site and after construction. Equipment stored in unheated or open areas on the site shall be covered and provided with thermostatically controlled heaters of sufficient size to keep the temperature of the equipment above the dew point. Control panels and other electrical equipment shall not be installed until the room in which they are to be installed is completely free of any dust, dirt, dampness, construction debris or any other contaminants that might affect the future operation of the electrical equipment.
	.2	Storage areas shall be made accessible to the Departmental Representative at any time for determining the condition of the storage.
1.23 Spare Parts	.1	The contractor shall supply, at minimum, the following spare parts: .1 Control circuit fuses (3 of each size and ampacity) .2 Fluorescent lamps (3 of each type and wattage)

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 CSA C22.2 No.65-93 - Wire Connectors.

PART 2 - PRODUCTS

2.1 Materials

.1 Pressure type wire connectors: with current carrying parts of copper sized to fit copper conductors as required.

.2 Fixture type splicing connectors: with current carrying parts of copper sized to fit copper conductors 10 AWG or less.

PART 3 - EXECUTION

3.1 INSTALLATION

.1 Remove insulation carefully from ends of conductors and:

.2 Install mechanical pressure type connectors and tighten screws with appropriate compression tool recommended by manufacturer. Installation shall meet secureness tests in accordance with CSA C22.2 No.65.

.3 Install fixture type connectors and tighten. Replace insulating cap.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 CSA C22.2 No. 38, Thermoset-Insulated Wires and Cables
.2 CSA C22.2 No. 0.3, Test Methods for Electrical Wires and Cables.
.3 TIA/EIA-568-C.1 (General Requirements)
.4 TIA/EIA-568-C.2 (Balanced Twisted-pair Cables)
.5 TIA/EIA-568-C.3 (Fiber-optic Cables)
.6 TIA/EIA-568-C.4 (Coaxial Cables)
.7 BICSI "Telecommunications Distribution Methods Manual (TDMM), 12th edition"

PART 2 – PRODUCTS

2.1 Teck Cable (600V rated) (Power & controls – indoors, outdoors & direct burial)

.1 Equipment characteristics:
  .1 Conductors: Stranded copper (solid copper conductors will not be accepted), size as indicated.
  .2 Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90, 600V.
  .3 Inner Jacket: PVC.
  .4 Armour: Interlocking aluminum.
  .5 Outer Jacket: PVC.

2.2 Teck Cable (1000V-rated) (where specifically noted, power & controls - indoors, outdoors & direct-burial)

.1 Equipment characteristics:
  .1 Conductors: Stranded copper (solid copper conductors will not be accepted), size as indicated.
  .2 Insulation: Chemically cross-linked thermosetting polyethylene rated type RW90, 1000V.
  .3 Inner Jacket: PVC.
  .4 Armour: Interlocking aluminum.
  .5 Outer Jacket: PVC.

2.3 Power Wiring (600V-rated) -

.1 Equipment characteristics:

Type RW90 (indoors and outdoors)

.1 Stranded copper conductors (solid copper conductors will not be accepted)

.2 Minimum size #12 AWG (larger as indicated on drawings)

.3 600V low-temperature, cross-linked, polyethylene insulation rated RW90, suitable for wet or dry locations

.4 Maximum 90C conductor temperature

.5 Minimum -40C installation temperature

.6 Insulation colors shall be as follows:

.1 1-phase AC (2 or 3 wire): Black (phase L1), Red (phase L2), White (neutral)

.2 3-phase AC: Red (phase A), Black (phase B), Blue (phase C), White (neutral)

.3 DC: Red (positive), Black (negative)

.4 Bond: Green

2.4 Power Wiring (1000V-rated) - Type RW90 (where specifically noted, indoors and outdoors

.1 Equipment characteristics:

.1 Stranded copper conductors (solid copper conductors will not be accepted)

.2 Minimum size #12 AWG (larger as indicated on drawings)

.3 1000V low-temperature, cross-linked, polyethylene insulation rated RW90, suitable for wet or dry locations

.4 Maximum 90C conductor temperature

.5 Minimum -40C installation temperature

.6 Insulation colors shall be as follows:

.1 1-phase AC (2 or 3 wire): Black (phase L1), Red (phase L2), White (neutral)

.2 3-phase AC: Red (phase A), Black (phase B), Blue (phase C), White (neutral)

.3 DC: Red (positive), Black (negative)

.4 Bond: Green

2.5 Controls Wiring - Type RW90 (external to control panels & MCCs)

.1 Equipment characteristics:

- .1 Stranded copper conductors (solid copper conductors will not be accepted)
- .2 Minimum size #14 AWG (unless otherwise indicated on drawings)
- .3 600V low-temperature, cross-linked, polyethylene insulation rated RW90, suitable for wet or dry locations
- .4 Maximum 90C conductor temperature
- .5 Minimum -40C installation temperature
- .6 Insulation colors shall be as follows:
  - .1 DC: Red (positive), Black (negative)
  - .2 AC: Black (line), White (neutral)
  - .3 Bond: Green

2.6 Controls Wiring - Type TEW (within control panels & MCCs)

.1 Equipment characteristics:

- .1 Stranded, flexible copper conductors (mimimum 26 strands)
- .2 Minimum size #16 AWG (where protected via maximum 10A fuse or circuit breaker), otherwise minimum size #14 AWG.
- .3 600V thermoplastic insulation type TEW, suitable for dry locations
- .4 Maximum 105C conductor temperature
- .5 Insulation colors shall be as follows:
  - .1 DC: Blue (positive), Yellow (negative)
  - .2 AC: Black (line), Red (switched), White (neutral)
  - .3 Bond: Green or Green with yellow stripe

2.7 Analog Signal Cables (indoors and within control panels & MCCs)

.1 Equipment characteristics:
- .1 Stranded, tinned copper conductors with 600V PVC insulation
- .2 #18 AWG (7 x #24 stranding) twisted pairs or triads with individual foil shielding & polyester isolation tape
- .3 Overall foil shielding (100% coverage)
- .4 #18 AWG stranded tinned copper drain wire, rip cord and outer black PVC jacket.
- .5 Minimum -25C installation temperature
- .6 Insulation colors shall be as follows:
  - .1 Pairs: Black (positive), White (negative)
  - .2 Triads: Black (positive), Red (signal), White (negative)

.2 Minimum Acceptable Standard:
- .1 1 pair: Belden #22417 or equal
- .2 2 pairs: Belden #22405 or equal
- .3 4 pairs: Belden #22404 or equal
- .4 8 pairs: Belden #22404 or equal
- .5 1 triad: Belden #22442 or equal
- .6 2 triads: Belden #22443 or equal
- .7 4 triads: Belden #22444 or equal
- .8 8 triads: Belden #22445 or equal

2.8 Ethernet Cable (indoors, external to control panels & MCCs)

.1 Equipment characteristics:

.1 CAT6A (600 Mhz) rated, compatible with 10GBaseT (and slower) networks

.2 8 x 23 AWG stranded copper conductors, arranged in 4 foil-shielded twisted pairs

.3 Tinned copper drain wire

.4 Outer PVC jacket.

.2 Minimum Acceptable Standard:

.1 Superior Essex "Category 6A STP" series

PART 3 – EXECUTION

3.1 Installation of Power Wiring

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In underground ducts in accordance with Section 26 05 43.01.

3.1 Installation of Controls Wiring

.1 Install wiring as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In underground ducts in accordance with Section 26 05 43.01.

.2 Label both ends of wiring with permanent, indelible wire markers. Wire number shall equal terminal number, except where noted otherwise. See drawings for details.

3.2 Installation of Analog Signal Cables

.1 Install cables as follows:

.1 In conduit systems in accordance with Section 26 05 34.

.2 In underground ducts in accordance with Section 26 05 43.01.

.2 Ground signal cable shields at one end only as shown on drawings.

.3 Label both ends of wiring with permanent wire markers. Wire number shall equal terminal number, except where noted otherwise. See drawings for details.

3.4 Installation of Teck Cables

.1 Label both ends of wiring (for control circuits) with permanent, indelible wire markers. Wire number shall equal terminal number, except where noted otherwise. See drawings for details.

.2 Fastenings:

- .1 One-hole steel straps to secure surface cables 50 mm and smaller. Two-hole steel straps for cables larger than 50 mm.
- .2 Channel type supports for two or more cables at minimum 1.0m centers.
- .3 Minimum 6mm diameter threaded rods to support suspended channels.

.3 Connectors:

- .1 Watertight, approved for Teck cable.
- .2 Explosion-proof in hazardous areas.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 C22.2 No. 0.4-M1982 (R1993) Bonding and Grounding of Electrical Equipment (Protective Grounding).

.2 C22.2 No. 41-M1987 (R1993) Grounding and Bonding Equipment

PART 2 - PRODUCTS

2.1 Equipment

.1 Rod electrodes: copper clad steel 19 mm diameter by 3.0 m long complete with inspection well unless noted otherwise on drawings.

.2 Grounding conductors: bare stranded copper, soft annealed, size as indicated on drawings.

.3 Non-corroding accessories necessary for grounding system, type, size, material as indicated, including but not necessarily limited to:

- .1 Grounding and bonding bushings.
- .2 Protective type clamps.
- .3 Bonding jumpers, straps.
- .4 Pressure wire connectors.

.4 Minimum Acceptable Standard:

- .1 Burndy "Hyground" series

.5 A grounding pad shall be installed if shown on the drawings. The grounding pad should be 760 min long x 76 mm wide x 6.35 mm thick copper mounted on the wall with a 25.4 mm air space using insulated spacers between the pad and the wall. The ground pad shall be drilled and tapped, as required, for various bonding.

PART 3 -EXECUTION

3.1 Installation - General

.1 Install complete permanent, continuous grounding and bonding system including, electrodes, conductors, connectors, accessories in

accordance with the requirements Section 10 of the Canadian Electrical Code and B.C. Amendments.

.2 Install artificial grounding electrodes and cabling as shown on the drawings and as specified herein.

.3 Metal water supply and discharge piping shall be utilized to form part of the system grounding electrode. A suitably-sized grounding conductor shall be run from both the suction and discharge pipes to the main building ground pad.

.4 Steel reinforcing bars installed in the foundation and floor slab concrete shall be utilized to form part of the system grounding electrode (ufer ground). Suitable grounding connectors and cable shall be used to interconnect the steel reinforcing bars. A suitably-sized grounding conductor shall be run to the main building ground pad.

.5 Make buried connections, and connections to electrodes, using inspectable wrought copper compression connectors to ANSI/IEEE 837.

.6 Use mechanical connectors for bonding connections to equipment provided with lugs.

.7 Soldered joints not permitted.

.8 Install bond wire for flexible conduit, connected at both ends to grounding bushing, solderless lug, clamp or cup washer and screw. Neatly cleat bonding wire to exterior of flexible conduit.

.9 Install separate bond conductor to outdoor lighting standards.

.10 Make bonding connections in radial configuration only, with connections terminating at single grounding point. Avoid loop connections.

.11 Where non-metallic conduit, flexible conduit, power cable or portable cable is called for, a bond conductor shall be installed with the power conductors.

.12 Metal waste water piping shall be bonded to the system grounding conductor with a #6 AWG copper conductor.

.13 All motor branch circuits shall include a separate copper grounding conductor sized in accordance with the overcurrent protection in the circuit and Table 16 of the Canadian Electrical Code.

.14 In addition, all non-current-carrying metal parts of electrical apparatus shall be bonded to the grounding system.

3.2 Electrodes

.1. Install rod electrodes and make grounding connections.

.2 Bond separate, multiple electrodes together.

3.3 Equipment Bonding

.1 Install bonding connections to typical equipment included in, but not necessarily limited to following list. Service equipment, transformers, switchgear, duct systems, frames of motors, motor control centres, starters, control panels, building steel work, generators, elevators and escalators, distribution panels, outdoor lighting.

3.4 Field Quality Control

.1 Perform ground continuity and resistance tests using method appropriate to site conditions and to approval of Departmental Representative and local authority having jurisdiction over installation. Report measured ground resistance to the Departmental Representative and, if required, install additional ground rods and cables to reduce ground resistance.

.2 Perform tests before energizing electrical system.

END OF SECTION

PART 1 - GENERAL

1.1 Related Work

.1 None

PART 2 - PRODUCTS

2.1 General

.1 Products as required.

PART 3 -EXECUTION

3.1 Installation

.1 The contractor shall ensure that all electrical equipment is seismically restrained in accordance with the requirements of the following:

- .1 Division B, Part 4, Section 4.1.8, "Earthquake Load and Effects" of the British Columbia Building Code
- .2 "Seismic Restraint Standards Manual" published by the Electrical Contractors Association of British Columbia

.2 Support equipment, conduit or cables using clips, spring loaded bolts, cable clamps designed as accessories to basic channel members.

.3 Provide metal brackets, frames, hangers, clamps and related types of support structures where indicated or as required to support conduit and cable runs.

.4 Ensure adequate support for raceways and cables dropped vertically to equipment where there is no wall support.

.5 Do not use wire lashing or perforated strap to support or secure raceways or cables.

.6 Do not use supports or equipment installed for other trades for conduit or cable support except with permission of other trade and approval of the Departmental Representative.

END OF SECTION

PART 1 - GENERAL

Not used.

PART 2 - PRODUCTS

2.1 Splitters

.1 Sheet metal enclosure, welded corners and formed hinged cover suitable for locking in closed position.

.2 Main and branch lugs to match required size and number of incoming and outgoing conductors as indicated.

.3 At least three spare terminals on each set of lugs in splitters less than 400 A.

2.2 Junction Boxes - Indoors

.1 Welded steel construction with screw-on flat covers for surface mounting.

2.3 Junction Boxes – Weatherproof (aluminium)

.1 EEMAC3, welded aluminum construction with hinged, gasketted covers and padlock hasp. Suitable for surface mounting.

2.4 Junction Boxes – Weatherproof (stainless steel)

.1 EEMAC3, welded stainless steel construction with hinged, gasketted covers and padlock hasp. Suitable for surface mounting.

2.5 Junction Boxes – Weatherproof (RPVC)

.1 EEMAC3, RPVC construction with gasketted cover and brass screws. Suitable for surface mounting.

2.6 Pull Boxes – Outdoors at Grade for Underground Conduit Runs

.1 Precast concrete, 2-sections deep as follows:

.1 Top section 580mm long x 405mm wide x 305mm deep.

.2 Bottom section 580mm long x 405mm wide x 305mm deep with conduit .3knockouts.

.3 Steel checkerplate cover marked “ELEC”, with bonding stud on underside.

.2 Minimum Acceptable Standard: A.E. Concrete Products Ltd. "#37 Brooks Boxes" series.

PART 3 - EXECUTION

3.1 Splitter Installation

.1 Install splitters and mount plumb, true and square to the building lines.

.2 Extend splitters full length of equipment arrangement except where indicated otherwise.

3.2 Indoor Junction, Pull Boxes and Cabinets Installation

.1 Install pull boxes in inconspicuous but accessible locations.

.2 Mount cabinets with top not higher than 2m above finished floor.

.3 Only main junction and pull boxes are indicated. Install pull boxes so as not to exceed 30m of conduit run between pull boxes.

3.3 Outdoor Pull Boxes Installation

.1 Pull box lids shall be bonded.

.2 Pull boxes shall be installed over freely-draining crushed aggregate (25mm minus) and supported by four 12" x 6" concrete pavers (one beneath each side of the junction box).

.3 Pull boxes shall be stacked two sections deep, such that the bottom of the pullbox is minimum 600mm below finished grade. Pull box lids shall flush with finished grade.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 CSA C22.1 Canadian Electrical Code, Part 1.

PART 2 - PRODUCTS

2.1 Outlet and Switch Boxes - General

.1 Size boxes in accordance with CSA C22.1.

.2 102 mm square or larger outlet boxes as required for special devices.

.3 Gang boxes where wiring devices are grouped.

.4 Blank cover plates for boxes without wiring devices.

.5 347 V outlet boxes for 347 V switching devices.

.6 Combination boxes with barriers where outlets for more than one system are grouped.

2.2 Outlet Boxes

.1 Where exposed conduit is used, surface mounted cast outlet boxes with gasketted cast cover plates shall be installed.

.2 Outlet boxes installed in concrete shall be of a type specifically designed and approved for this service.

2.3 Switch Boxes

.1 Switch and receptacle boxes installed exposed shall be cast iron or aluminum with metal covers and threaded hubs for conduit connections.

.2 Switch boxes installed in concrete shall be of a type specifically designed and approved for this service.

2.4 Fittings – General

.1 Bushing and connectors with nylon insulated throats

.2 Knock-out fillers to prevent entry of debris.

.3 Conduit outlet bodies for conduit up to 32 mm and pull boxes for larger conduits.

.4 Double locknuts and insulated bushings on sheet metal boxes.

PART 3 - EXECUTION

3.1 Installation

.1 Support boxes independently of connecting conduits.

.2 Fill boxes with paper, sponges or foam or similar approved material to prevent entry of debris during construction. Remove upon completion of work.

.3 For flush installations mount outlets flush with finished wall using plaster rings to permit wall finish to come within 6 mm of opening.

.4 Provide correct size of openings in boxes for conduit, mineral insulated and armoured cable connections. Reducing washers are not allowed.

END OF SECTION

PART 1 - GENERAL

1.1 Location of Conduit

.1 Drawings do not indicate all conduit runs. Those indicated are in diagrammatic form only.

PART 2 - PRODUCTS

2.1 Conduits

.1 Rigid galvanized steel threaded conduit.

.2 Electrical metallic tubing (EMT) with couplings.

.3 Rigid PVC conduit.

2.2 Conduit Fastenings

.1 One hole steel straps to secure surface conduits 50mm and smaller. Two hole steel straps for conduits larger than 50mm.

.2 Beam clamps to secure conduits to exposed steel work.

.3 Channel type supports for two or more conduits at 1.0m maximum spacing.

.4 6mm diameter threaded rods to support suspended channels.

2.3 Conduit Fittings

.1 Fittings: manufactured for use with conduit specified. Coating: same as conduit.

.2 Factory "ells" where 90 degree bends are required for 25mm and larger conduits.

.3 Watertight connectors and couplings for EMT. Set-screws are not acceptable.

2.4 Fish Cord

.1 Polypropylene.

PART 3 - EXECUTION

3.1 Installation

.1 Install conduits to conserve headroom in exposed locations and cause minimum interference in spaces through which they pass.

.2 Surface mount conduits except where noted otherwise.

.3 Use rigid galvanized steel threaded conduit except where specified otherwise.

.4 Use electrical metallic tubing (EMT) only where not subject to mechanical injury.

.5 Use rigid PVC conduit underground.

.6 Minimum conduit size for lighting and power circuits: 19mm.

.7 Bend conduit cold. Replace conduit if kinked or flattened more than 1/10th of its original diameter.

.8 Mechanically bend steel conduit over 19mm dia.

.9 Field threads on rigid conduit must be of sufficient length to draw conduits up tight.

.10 Install fish cord in empty conduits.

.11 Where conduits become blocked, remove and replace blocked section. Do not use liquids to clean out conduits.

.12 Dry conduits out before installing wire.

3.2 Surface Conduits

.1 Run parallel or perpendicular to building lines.

.2 Locate conduits behind infrared or gas fired heaters with 1.5m clearance.

.3 Run conduits in flanged portion of structural steel.

.4 Group conduits wherever possible on suspended surface channels.

.5 Do not pass conduits through structural members except as indicated.

.6 Do not locate conduits less than 75mm parallel to steam or hot water lines with minimum of 25mm at crossovers.

3.3 Concealed Conduits

.1 Run parallel or perpendicular to building lines.

.2 Do not install horizontal runs in masonry walls.

		.3	Do not install conduits in terrazzo or concrete toppings.
3.4	Conduits in Cast-in-place Concrete	.1	Locate to suit reinforcing steel. Install in centre one third of slab.
		.2	Protect conduits from damage where they stub out of concrete.
		.3	Install sleeves where conduits pass through slab or wall.
		.4	Where conduits pass through waterproof membrane provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
		.5	Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
		.6	Encase conduits completely in concrete with minimum 25mm concrete cover.
		.7	Organize conduits in slab to minimize cross-overs.
3.5	Conduits in Cast-in-place Slabs on Grade	.1	Locate to suit reinforcing steel. Install in centre one third of slab.
		.2	Protect conduits from damage where they stub out of concrete.
		.3	Install sleeves where conduits pass through slab or wall.
		.4	Where conduits pass through waterproof membrane provide oversized sleeve before membrane is installed. Use cold mastic between sleeve and conduit.
		.5	Do not place conduits in slabs in which slab thickness is less than 4 times conduit diameter.
		.6	Encase conduits completely in concrete with minimum 25mm concrete cover.
		.7	Organize conduits in slab to minimize cross-overs.
3.6	Conduits Underground	.1	Slope conduits to provide drainage.
		.2	Waterproof joints (PVC excepted) with heavy coat of bituminous paint.

END OF SECTION

PART 1 - GENERAL

1.1 Related Work

.1 Excavation and backfilling: Section 31 00 99 – Earthworks for Minor Works.

PART 2 - PRODUCTS

2.1 Markers

.1 150 mm wide polyethylene warning tape marked "Warning - Buried Electric Line".

PART 3 - EXECUTION

3.1 Direct Burial of Cables

.1 After sand bed is in place, lay cables maintaining 75 mm clearance from each side of trench to nearest cable. Do not pull cable into trench.

.2 Provide offsets for thermal action and minor earth movements. Offset cables 150 mm for each 60 m run, maintaining minimum cable separation and bending radius requirements.

.3 Underground cable splices are not acceptable.

.4 Minimum permitted radius at cable bends for rubber, plastic or lead covered cables, 8 times diameter of cable; for metallic armoured cables, 12 times diameter of cables or in accordance with manufacturer's instructions.

.5 Maintain 75 mm minimum separation between cables of different circuits. Maintain 300 mm horizontal separation between low and high voltage cables. When low voltage cables cross high voltage cables maintain 300 mm vertical separation with low voltage cables in upper position. At crossover, maintain 75 mm minimum vertical separation between low voltage cables and 150 mm between high voltage cables. Maintain 300 mm minimum lateral and vertical separation for fire alarm and control cables when crossing other

cables, with fire alarm and control cables in upper position. Install treated planks on lower cables 0.6 m in each direction at crossings.

3.2 Cable Installation in Ducts

.1 Install cables as indicated in ducts.

.2 Do not pull spliced cables inside ducts.

.3 Install multiple cables in duct simultaneously.

.4 Use CSA approved lubricants of type compatible with cable jacket to reduce pulling tension.

.5 To facilitate matching of colour coded multiconductor control cables reel off in same direction during installation.

.6 Before pulling cable into ducts and until cables properly terminated, seal ends of lead covered cables with wiping solder; seal ends of non-leaded cables with moisture seal tape.

.7 After installation of cables, seal duct ends with duct sealing compound.

3.3 Markers

.1 Mark cable every 150 m along cable duct runs and changes in direction.

.2 Where markers are removed to permit installation of additional cables, reinstall existing markers.

3.4 Field Quality Control

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Perform tests using qualified personnel. Provide necessary instruments and equipment.

.3 Check phase rotation and identify each phase conductor of each feeder.

.4 Check each feeder for continuity, short circuits and grounds. Ensure resistance to ground of circuits is not less than 50 megohms.

.5 Pre-acceptance tests.

.1 After installing cable but before splicing and terminating, perform insulation resistance test with 1000 V megger on each phase conductor.

.2 Check insulation resistance after each splice and/or termination to ensure that cable system is ready for acceptance testing.

.6 Acceptance Tests

.1 Ensure that terminations and accessory equipment are disconnected.

.2 Ground shields, ground wires, metallic armour and conductors not under test

.7 Provide Departmental Representative with list of test results showing location at which each test was made, circuit tested and result of each test.

.8 Remove and replace entire length of cable if cable fails to meet any of test criteria.

END OF SECTION

PART 1 - GENERAL

1.1 Operation and Maintenance Data

.1 Provide operation and maintenance data for electric heating and cooling equipment for incorporation into manual specified in Section 26 05 00 - Common Work Results – Electrical.

PART 2 - PRODUCTS

2.1 Heating Equipment & Controls:

2.1.1 Electric Heat Tracing (for pipe freeze protection)

.1 Equipment Characteristics:

.1 Self-regulating, cut-to-length, parallel type.

.2 5 W/ft output at 10 deg C, 1 W/ft output at 46 deg C.

.3 16 AWG nickel-plated copper bus wires, tinned-copper braid with modified polyolefin jacket.

.4 120VAC operation.

.5 CSA-approved.

.2 Minimum Acceptable Standard:

.1 Heating Cable: Pentair Raychem "BTV" series #5BTV1-CR

.2 Power Connection: Pentair Raychem #JBS-100

.3 End Seal Kit: Pentair Raychem #E-150

.4 Glass Cloth Tape: Pentair Raychem #GT-66

.5 Aluminum Tape: Pentair Raychem #AT-180

.6 "Electric Traced" Caution Label: Pentair Raychem #ETL

2.1.2 Electric Heat Tracing Controller

.1 Equipment Characteristics:

.1 Electronic single-channel heat tracing controller

.2 Integral ground fault sensing and trip

.3 One Type J thermistor (10 KΩ @ 25°C) with 7.6m cable included. Measures pipe surface, slab or ambient temperature.

.4 Digital display and keypad for programming and status monitoring

.5 Form-C dry alarm contact rated 2A @ 277 VAC. Alarms on low & high temperature, temperature sensor failure, and ground fault.

.6 EEMAC 4X FRP wall-mount enclosure (pipe-mounting kit available)

.7 2-pole output relay rated 277 VAC @ 30A.

.8 100 to 277 VAC supply voltage

.9 cUL-listed

.2 Minimum Acceptable Standard:

.1 Pentair Raychem "Digitrace" #ECW-GF

2.2 Ventilation Equipment & Controls:

2.2.1 Timer Switch (for exhaust fan)

.1 Equipment Characteristics:

.1 Light switch style

.2 500W / 1/6hp capacity at 120 VAC

.3 Adjustable time delay from 1 minute to 18 hours

.4 Beeper to notify operator 15 seconds before time expires

.5 Complete with faceplate switch

.6 CSA approved

.2 Minimum Acceptable Standard:

.1 Leviton “Decora” series, cat. #6652-1W

PART 3 - EXECUTION

3.1 Installation

.1 Suspend room unit heater(s) from ceiling or mount on wall as indicated.

.2 Mount kiosk unit heater(s) on the removable backpan in the kiosk compartment as indicated.

.3 Mount control panel heater(s) on the removable backpan in the control panel as indicated.

.4 Mount thermostats as indicated.

.5 Make power and control connections.

3.2 Field Quality Control

.1 Perform tests in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Test cut-out protection when air movement is obstructed.

.3 Test fan delay switch to assure dissipation of heat after element shut down.

.4 Test unit cut-off when fan motor overload protection has operated.

.5 Ensure that heaters and controls operate correctly.

END OF SECTION

PART 1 - GENERAL

Not used.

PART 2 - PRODUCTS

2.1 Switches - Standard Type

.1 Manually-operated, general purpose, 15A, 120VAC switches with following features:

- .1 Brass terminal screws approved for up to No. 10 AWG wire.
- .2 Silver cadmium oxide contacts.
- .3 Thermoset base and face.
- .4 Urea insulating safety barrier
- .5 Nylon toggle, white color.
- .6 ½ hp rated at 120 VAC.
- .7 1-way or 3-way as indicated on drawings
- .8 Industrial grade.
- .9 Minimum Acceptable Standard: Bryant #4801W (1-way), Bryant #4803W (3-way).

.2 Other switches with ampacity and voltage as indicated.

.3 Switches of one manufacturer throughout project.

2.2 Receptacles

.1 Duplex receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

- .1 One-piece grounding system including integral self-grounding strap.
- .2 White, full-face, wraparound design molded from high-impact, chemical-resistant nylon.
- .3 Suitable for No. 10 AWG for back and side wiring.
- .4 Break-off links for use as split receptacles.
- .5 Eight back wired entrances, four side wiring screws.

.6 Triple wipe brass line contacts and double wipe brass grounding contacts.

.7 Minimum Acceptable Standard: Industrial Specification grade. Bryant #BRY5262W.

.2 Duplex ground fault circuit interrupter (GFCI) receptacles, CSA type 5-15 R, 125 V, 15 A, U ground, with following features:

.1 Conforms to all CSA requirements for Class A GFCI receptacles.

.2 Can be wired to protect additional downstream receptacles on the same circuit.

.3 Face and base made of impact-resistant, thermoplastic material.

.4 White-color face.

.5 Integral "test" & "reset" buttons.

.6 Triple wipe brass line contacts.

.7 Minimum Acceptable Standard: Bryant #GFR52.

.3 Other receptacles with ampacity and voltage as indicated.

.4 Receptacles of one manufacturer throughout project.

2.3 Cover Plates

.1 Cover plates for wiring devices.

.2 Cover plates from one manufacturer throughout project.

.3 Sheet steel utility box cover for wiring devices installed in surface-mounted utility boxes.

.4 Stainless steel, vertically brushed, 1 mm thick cover plates, for wiring devices mounted in flush-mounted outlet box.

.5 Sheet metal cover plates for wiring devices mounted in surface-mounted cast type conduit boxes.

.6 Weatherproof, deep-style, "While-in-Use" hinged polycarbonate cover, complete with padlock tab, mounting plate & gasket for outdoor receptacles and others as indicated.

.7 Minimum Acceptable Standard: Hubbell #RW57xxx.

PART 3 - EXECUTION

3.1 Installation

.1 Switches:

.1 Install single throw switches with handle in "UP" position when switch closed.

.2 Install switches in gang type outlet box when more than one switch is required in one location.

.3 Mount toggle switches at height specified in Section 26 05 02 - Common Work Results – Electrical or as indicated.

.2 Receptacles:

.1 Install receptacles in gang type outlet box when more than one receptacle is required in one location.

.2 Mount receptacles at height specified in Section 26 05 02 - Common Work Results – Electrical or as indicated.

.3 Test all receptacles for proper wiring and test GFCI receptacles for proper tripping operation.

.3 Cover plates:

.1 Protect stainless steel cover plate finish with paper or plastic film until painting and other work is finished.

.2 Install suitable common cover plates where wiring devices are grouped.

.3 Do not use cover plates meant for flush outlet boxes on surface-mounted boxes.

END OF SECTION

PART 1 - GENERAL

1.1 References
.1 CSA C22.2 No. 5, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit-Breaker Enclosures

1.2 Shop Drawings
.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results – Electrical.

PART 2 - PRODUCTS

2.1 Circuit Breaker - Branch Circuit (80%-rated)
.1 Moulded case circuit breaker to operate automatically by means of thermal and magnetic tripping devices to provide inverse time current tripping and instantaneous tripping for short circuit protection.
.2 Rated to carry 80% of nameplate current on a continuous basis, and 100% of nameplate current for short periods of time.
.3 Trip-free mechanism.
.4 All poles mechanically interconnected to prevent single-phasing.
.5 Voltage, ampacity and interrupting capacity as shown on the drawings.
.6 Front-operated and capable of being padlocked in either the ON or OFF position.
.7 EEMAC1 general purpose enclosure finished in light grey (ASA-61) baked enamel (where needed).
.8 Non-interchangeable trip unit.
.9 Minimum Acceptable Standard:
.1 Eaton Cutler-Hammer - Series “C"

2.2 Circuit Breakers – in Panelboards & Loadcenters
.1 Bolt-on moulded case circuit breaker: quick- make, quick-break type, for manual and automatic operation.
.2 Common-trip breakers: with single handle for multi-pole applications
.3 Trip-free mechanism.

.4 Voltage, ampacity and interrupting capacity as shown on the drawings.

.5 GFCI circuit breakers shall have the following additional features:

.1 Class A (6 mA) ground fault trip

.2 Visible trip indicator

.6 Minimum Acceptable Standard:

.1 Cutler-Hammer "Quicklag" series

PART 3 - EXECUTION

3.1 Installation

.1 Install circuit breakers as indicated.

END OF SECTION

PART 1 - GENERAL

1.1 Product Data

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results – Electrical.

PART 2 - PRODUCTS

2.1 Disconnect Switches

.1 Equipment Characteristics:

- .1 Fusible or non-fusible, horsepower-rated disconnect switch in EEMAC type 1 (indoor) or type 3R or 4/4X (outdoor) enclosure, size as indicated.
- .2 Outdoor disconnect switches shall have stainless steel enclosure.
- .3 Provision for padlocking in OFF position by one lock.
- .4 Mechanically interlocked door to prevent opening when handle in ON position.
- .5 Quick-make, quick-break action.
- .6 ON-OFF switch position indication on switch enclosure cover.

.2 Minimum Acceptable Standard:

- .1 Cutler Hammer "HD" series
- .2 Square D "heavy duty" series

2.2 Equipment Identification

.1 Provide equipment identification in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Indicate name of load controlled.

PART 3 - EXECUTION

3.1 Installation

.1 Install disconnect switches within sight of, and in close proximity to, connected equipment.

.2 Install disconnect switches complete with fuses, where required.

END OF SECTION

PART 1 - GENERAL

1.1 Shop Drawings

.1 Submit shop drawings and product data in accordance with Section 26 05 00 - Common Work Results – Electrical.

.2 Include schematic, wiring, interconnection diagrams.

PART 2 - PRODUCTS

2.1 General

.1 For each type of controls and instrumentation equipment, use products of one manufacturer throughout project.

.2 Note that some of the controls and instrumentation equipment listed below may not be utilized for this project. The contractor shall refer to the drawings to identify which equipment is required.

2.2 DC Power Supplies (24 VDC @ 2.5 A)

.1 Equipment Characteristics:

.1 120 VAC input

.2 2.5 A, 24 VDC adjustable output, +/- 2% regulation, <25mV peak-peak ripple

.3 Switching type, capable of parallel operation

.4 Protected against output short circuit, overload, open-circuit, input overvoltage

.5 "On" LED indicator

.6 35mm DIN rail mounting

.2 Minimum Acceptable Standards:

.1 Sola "SDN" series. Cat. #SDN2.5-24-100

.2 Phoenix Contact "TRIO" series. Cat. #TRIO-PS/1AC/24DC/2.5

2.3 Enclosures – Wall-Mounted Single Door Control Panel without Disconnect Switch

.1 Equipment Characteristics:

.1 Height & width as shown on drawings. Minimum 10" depth (greater, if required)

.2 Single door with quarter-turn latches, interior data pockets

.3 Full size interior backpan

.4 EEMAC12, 14 gauge, steel body & doors with welded seams

.5 ANSI61 grey exterior, white enamel interior

.6 With optional wall-mounting foot kit

.7 With optional door stop kit

.2 Minimum Acceptable Standard:

.1 Hoffman "Concept - Bulletin CW1" series

2.4 Flow Transmitters

.1 Equipment Characteristics:

.1 Magnetic flow transmitter

.2 Compact version: sensor and transmitter form one mechanical unit.

.3 120VAC operation

.4 4-20mA, 2-wire output, 700 ohms loop impedance capacity

.5 Open-collector pulse output, 30VDC @ 250mA, passive, isolated

.6 2-line, illuminated display of process and configuration information. Handheld remote programmer.

.7 Sensor with polyurethane liner for water & wastewater applications

.8 Operating pressure, flow range, sensor diameter and flange type to be as specified by civil engineer. Confirm with civil engineer prior to purchase.

.9 Cast aluminum EEMAC4X (IP67) transmitter housing c/w ½" NPT cable entries.

.10 Repeatability: +/- 0.2% of rate

.11 Ambient temperature range: -20°C to +60°C

.12 Note: Include optional grounding rings (2) for flow sensor flanges when used with non-conductive forcemain piping (ie. plastic pipe or lined/coated metal pipe).

.2 Minimum Acceptable Standard:

.1 Endress & Hauser "Promag W400" series

2.5 Indicating Lights

.1 Equipment Characteristics:
- .1 120 VAC operation
- .2 LED lamps
- .3 Fits 30.5mm cutout
- .4 EEMAC 4 & 13 (IP65) rating
- .5 Lens color and nameplate as shown on drawings
- .6 Push-to-test type (if indicated on drawings)

.2 Minimum Acceptable Standards:
- .1 Allen-Bradley "Bulletin 800T" series
- .2 Idec "TWTD" series
- .3 Siemens "Class 52 Heavy Duty Watertight/Oiltight" series

2.6 Meters - Elapsed Time

.1 Equipment Characteristics:
- .1 120 VAC power input
- .2 Electro-mechanical type
- .3 0.01 hours resolution, 0 – 99999.99 hours range
- .4 Non-resettable
- .5 48mm x 48mm housing, flush panel mount
- .6 Operation indication
- .7 CSA-approved

.2 Minimum Acceptable Standards:
- .1 Intermatic Grasslin #UWZ48E-120U
- .2 Veeder-Root "7795" series, #779516-201

2.7 Potentiometers

.1 Equipment Characteristics:
- .1 Resistance and power rating as noted on drawings
- .2 Linear taper with 270 degree rotational sweep
- .3 Vibration-resistant
- .4 Fits 30.5mm cutout
- .5 EEMAC 4 & 13 (IP65) rating

.2 Minimum Acceptable Standard:

.1 Allen-Bradley "Bulletin 800T" series

2.8 Pressure Transmitters – Submersible Type for Water Wells

.1 Equipment Characteristics:

.1 Submersible gauge pressure transmitter (relative to atmosphere)

.2 4-20mA, 2-wire output with superimposed HART 6.0 digital communications

.3 10.5 to 35VDC operating voltage

.4 316 stainless steel housing, 22mm (0.87") outer diameter, IP68 enclosure rating, EPDM seal.

.5 Polyethylene jacketed extension cable with integral strain-relief members, pressure equalization tube

.6 Static accuracy: +/-0.2% of full scale

.7 Pressure/depth range to be confirmed with civil engineer prior to purchase.

.8 Ambient temperature range: -10°C to +70°C

.9 Suitable for non-hazardous areas

.10 Complete with the following options:

.1 Potable water approval

.2 CSA approval

.3 Mounting clamp

.4 Aneroid bellows for pressure equalization tube (instead of standard Teflon filter)

.2 Minimum Acceptable Standards:

.1 Pressure Transmitter: Endress & Hauser "Waterpilot FMX21" series

Aneroid Bellows: Keller "Type AB" or KPSI #815

2.9 Pushbuttons

.1 Equipment Characteristics:

.1 1 normally open, 1 normally closed, momentary contacts
.2 Fits 30.5mm cutout
.3 Red flush head (or other color as shown on drawings)
.4 EEMAC 4 & 13 rating
.5 Nameplate as shown on drawings

.2 Minimum Acceptable Standards:
.1 Allen-Bradley "Bulletin 800T" series. Cat. # 800T-A6A
.2 Idec "TWTD" series
.3 Siemens "Class 52 Heavy Duty Watertight/Oiltight" series

2.10 Relays – AC Control

.1 Equipment Characteristics:
.1 General-purpose, enclosed type with unsealed housing
.2 120VAC or 240VAC coil, as shown on drawings
.3 4 pole, double-throw contacts (4PDT)
.4 LED operation indicator
.5 Push-to-test button
.6 Plug-in style with matching front-connecting socket for 35mm symmetrical DIN mounting track

.2 Minimum Acceptable Standards:
.1 Idec "RU" series
.1 Relay cat. #RU4S-A110 (120VAC coil)
.2 Relay cat. #RU4S-A220 (240VAC coil)
.3 Socket cat. #SY4S-05
.2 Omron "MY" series
.1 Relay cat. #MY4IN-AC120 (120VAC coil)
.2 Relay cat. #MY4IN-AC240 (240VAC coil)
.3 Socket cat. #PYF14A-E

2.11 Relays – AC Power

.1 Equipment Characteristics:

.1 General-purpose, enclosed type with unsealed housing

.2 120VAC coil

.3 4 pole, double-throw contacts (4PDT) rated 10A resistive, 7.5A inductive @ 120 VAC

.4 LED operation indicator

.5 Push-to-test button

.6 Plug-in style with matching front-connecting socket for 35mm symmetrical DIN mounting track

.2 Minimum Acceptable Standard:

.1 Idec "RH" series

.1 Relay cat. #RH4B-ULC-AC120V

.2 Socket cat. #SH4B-05

2.12 Relays – AC Timing (On-delay or Interval type)

.1 Equipment Characteristics:

.1 Solid-state, enclosed type

.2 120VAC coil

.3 Double pole, double-throw output contacts (DPDT)

.4 0.05 sec. – 180 hrs. adjustable on-delay via labelled dial

.5 LED operation indicators

.6 Track-mount socket for 35mm symmetrical DIN mounting track

.2 Minimum Acceptable Standards:

.1 Idec "GT3A" series

.1 Relay cat. #GT3A-3AF20

.2 Socket cat. #SR2P-05

.2 Omron "H3CR" series

.1 Relay cat. #H3CR-A8-AC100-240

.2 Socket cat. #P2CF-08

2.13 Relays – AC Timing (Off-delay or Repeat Cycle type)

.1 Equipment Characteristics:
- .1 Solid-state, enclosed type
- .2 120VAC coil
- .3 Double pole, double-throw output contacts (DPDT)
- .4 0.05 sec. – 180 hrs. adjustable on-delay via labelled dial
- .5 LED operation indicators
- .6 Track-mount socket for 35mm symmetrical DIN mounting track

.2 Minimum Acceptable Standards:
- .1 Idec "GT3F" series
  - .1 Relay cat. #GT3F-2AF20
  - .2 Socket cat. #SR2P-05
- .2 Omron "H3CR" series
  - .1 Relay cat. #H3CR-A-AC100-240
  - .2 Socket cat. #P2CF-08

2.14 Relays – DC Control

.1 Equipment Characteristics:
- .1 General-purpose, enclosed type with unsealed housing
- .2 24VDC coil
- .3 4 pole, double-throw contacts (4PDT)
- .4 LED operation indicator
- .5 Push-to-test button
- .6 Plug-in style with matching front-connecting socket for 35mm symmetrical DIN mounting track

.2 Minimum Acceptable Standards:
- .1 Idec "RU" series
  - .1 Relay cat. #RU4S-D24
  - .2 Socket cat. #SY4S-05
- .2 Omron "MY" series
  - .1 Relay cat. #MY4IN-DC24
  - .2 Socket cat. #PYF14A-E

2.15 Remote Telemetry Units (RTU)

.1 Equipment Characteristics:

.1 32-bit controller with integrated Ethernet port

.2 #5606 lower I/O module c/w 32 digital inputs, 16 dry-contact digital output, 8 configurable analog inputs.

.3 Including optional 2 X #5305 analog output modules with 2 x 0-20mA analog outputs (4 total)

.4 2 x RS232, 1 x RS232/485, 1 x Ethernet ports

.5 No gas flow runtime option.

.6 Modbus protocol with TelePACE ladder logic and C language firmware loaded – IEC enabled

.7 0-20mA single-ended analog inputs, configurable to 0-5V / 0-10V or 0-20mA / 4-20Ma

.8 24V digital inputs, dry-contact digital outputs

.2 Minimum Acceptable Standard:

.1 RTU: Schneider "SCADAPack 357" #TBUP357-1A20-AB20.

2.16 Signal Isolators – 0/4-20mA to 0/4-20mA (3-port)

.1 Equipment Characteristics:

.1 0/4-20mA input, 70Ω input impedance (<1.5VDC drop)

.2 0/4-20mA output, 600Ω max. impedance

.3 24 VDC supply voltage

.4 3-way galvanic isolation

.5 Adjustable zero & span

.6 0.05% accuracy & linearity

.7 TS35 DIN rail mount

.2 Minimum Acceptable Standard:

.1 Weidmuller "ACT20M" series, Cat. #1175980000

2.17 Signal Protectors (field-mounted, for 24VDC circuits)

.1 Equipment Characteristics:

.1 Inline surge protector for process control & data signals

.2 Gas tube & silicon avalanche diode surge suppression

.3 PTC resistors for fault current mitigation
.4 Sealed 316 stainless steel pipe housing with ¾" NPT threading
.5 Maximum signal voltage 28 VDC
.6 Clamping voltage 72V L-L and 36V L-G
.7 400 occurrences @ 1000A, 10x1000 µsec. surges
.8 5Ω insertion resistance per conductor

.2 Minimum Acceptable Standard:
.1 Emerson "Edco SS64/SS65" series, model # SS64-036-2.

2.18 Signal Protectors (within control panels, for 24VDC circuits)

.1 Equipment Characteristics:
.1 Inline surge protector for process control & data signals
.2 Gas tube & silicon avalanche diode surge suppression
.3 PTC resistors for fault current mitigation
.4 Edge-card enclosure with matching base
.5 Nominal signal voltage 24 VDC
.6 Clamping voltage 36V L-G
.7 Peak surge current 10 occurrences @ 10kA, 8x20 µsec. surges
.8 5Ω insertion resistance per conductor
.9 Listed to UL 497B

.2 Minimum Acceptable Standard:
.1 Emerson "Edco PC642" series, model # PC642C-036 with #PCB1B base

2.19 Terminal Blocks - Regular

.1 Equipment Characteristics:
.1 Minimum 600V, 32A rating
.2 Modular
.3 Polyamide or "Wemid" material
.4 Zinc-plated, hardened steel clamping body with 4mm sq. cross section
.5 35mm DIN symmetrical rail mounting

.2 Minimum Acceptable Standards:

.1 Weidmuller "W" series. Type #WDU4

.2 Wieland "WK" series. Type #WK4/U

2.20 Terminal Blocks – Circuit Breaker Type

.1 Equipment Characteristics:

.1 Up to 63A trip @ 600VAC or 50 VDC

.2 1, 2 or 3-pole, trip setting as shown on drawings

.3 Thermal-magnetic type with trip handle

.4 10kA interrupting capacity

.5 35mm DIN symmetrical rail mounting

.2 Minimum Acceptable Standards:

.1 Weidmuller "91H" series.

.2ABB "S200" series

2.21 Variable Frequency Drives (for well pumps)

.1 Equipment Characteristics:

.1 600VAC, 3-phase, 3-wire 60 hz. input, 575VAC, 3-phase, 3-wire output

.2 Input & output current shall be rated to deliver the service factor ampacity (not the full-load ampacity) of the motor on a continuous basis. 5 hp motor, 6.9 full-load amps, 7.9 service-factor amps. Confirm actual motor FLA and SFA prior to ordering.

.3 Overload capacity 120% for 60 seconds

.4 Capable of uninterrupted operation during momentary 25% input voltage dips

.5 Automatic restart following undervoltage or overvoltage trips

.6 Internal, adjustable motor overload protection

.7 Analog 4-20mA isolated input for speed reference

.8 Analog 4-20mA isolated output for speed feedback

.9 Discrete inputs for "Run" and "Fault Reset" commands

.10 Dry-contact outputs to indicate "Running" and "Fault" conditions

.11 Suitable for water well pump application

.12 dV/dt output filters

.2 Minimum Acceptable Standards:

.1 VFD unit: Yaskawa "P1000" series, model #CIMR-PU5A0009

dV/dt Output Filter: MTE "Series A" or TCI "V1K" series

2.22 Wire Gutters

.1 Equipment Characteristics:

.1 Size as shown on drawings

.2 Slotted with snap-on cover

.3 Light grey PVC material

.2 Minimum Acceptable Standards:

.1 Panduit "Type E" with "Type C" cover

.2 Wieland type "DNG

PART 3 - EXECUTION

3.1 Installation

.1 Install pushbutton stations, control and relay panels, control and instrumentation devices and interconnect as shown on drawings.

.2 Install all equipment in exact accordance with manufacturer's instructions.

3.2 Field Quality Control

.1 Upon completion of control panel fabrication, but prior to shipment to site, the fabrication shop shall notify the Departmental Representative in writing. The Departmental Representative will perform inspection and testing of the panels at the fabrication shop. Demonstrate proper operation of all controls and instrumentation equipment to Departmental Representative and correct all identified deficiencies prior to shipment to site.

.2 Configure, calibrate and test all controls and instrumentation equipment.

.3 Depending upon magnitude and complexity, divide control system into convenient sections, energize one section at a time and check out operation of section.

.4 Upon completion of sectional test, undertake group testing.

.5 Check out complete system for operational sequencing.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 ANSI C82.4-1985, Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps.

1.2 Shop Drawings and Product Data

.1 Submit shop drawings and product data in accordance with Section 26 05 02 - Common Work Results - Electrical.

PART 2 - PRODUCTS

2.1 Type C Luminaires (corrosion-resistant, for plant floor areas)

.1 Equipment characteristics:

- .1 Industrial-grade fluorescent luminaire
- .2 Polyester fibreglass housing
- .3 Gasketted for damp locations
- .4 Ceiling-mounting
- .5 Nominal dimensions: 1270 mm long x 206 mm wide x 121 mm high
- .6 120 VAC, instant-start electronic ballast, <10% THD
- .7 2 x 32W cool-white, T8, medium bipin lamps
- .8 Shatter-resistant clear acrylic diffuser with captive latches

.2 Minimum Acceptable Standard:

- .1 Lithonia “DMW” series, cat. #DMW-2-32-120-GEB10IS

PART 3 - EXECUTION

3.1 Installation

.1 Locate and install luminaires as indicated.

3.2 Luminaire Alignment

.1 Align luminaires mounted in continuous rows to form straight uninterrupted line.

.2 Align luminaires mounted individually parallel or perpendicular to building grid lines.

3.3 Photocell Adjustment

.1 Orient photocell facing north.

.2 Adjust sliding shutter for activation at dusk.

END OF SECTION

PART 1 - GENERAL

1.1 References

.1 American Society for Testing and Materials International (ASTM)

- .1 ASTM C88-13, Test Method for Soundness of Aggregates by Use of Sodium Sulphate or Magnesium Sulphate.
- .2 ASTM C136-14, Method for Sieve Analysis of Fine and Coarse Aggregate.
- .3 ASTM C117-13, Test Method for Material Finer than 0.075 mm Sieve in Mineral Aggregates by Washing.
- .4 ASTM D1557-12, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort.

.2 Canadian Standards Association (CSA International)

- .1 CSA A23.1/ A23.2-09, Concrete Materials and Methods of Concrete Construction.

1.2 Regulations

.1 Shore and brace excavations, protect slopes and banks and perform all work in accordance with Provincial and Municipal regulations whichever is more stringent.

.2 Not later than one week before backfilling or filling, provide to designated testing agency, 23 kg sample of backfill or fill materials proposed for use.

.3 Do not begin backfilling or filling operations until material has been approved for use by the Departmental Representative.

.4 Not later than 48 hours before backfilling or filling with approved material, notify the Departmental Representative so that compaction tests can be carried out by designated testing agency.

.5 Before commencing work, conduct, with the Departmental Representative, condition survey of existing structures, trees and other plants, lawns, fencing, service poles, wires, rail tracks and paving, survey bench marks and monuments which may be affected by work.

1.3 Tests and Inspections

.1 Testing of materials and compaction of backfill and fill will be

carried out by a certified testing firm, retained by the Contractor and approved by the Departmental Representative.

1.4 Buried Services

.1 Before commencing work, verify the location of all buried services on and adjacent to the site using ground penetrating radar.

.2 Arrange with appropriate authority for relocation of buried services that interfere with execution of work. Pay costs of relocating services.

.3 Remove obsolete buried services within 2 m of foundations. Cap cut offs.

1.5 Protection

.1 Protect excavations from freezing.

.2 Keep excavations clean, free of standing water, and loose soil.

.3 Where soil is subject to significant volume change due to change in moisture content, cover and protect to the Departmental Representative's approval.

.4 Protect natural and manmade features required to remain undisturbed. Unless otherwise indicated or located in an area to be occupied by new construction, protect existing trees from damage.

.5 Protect buried services that are required to remain undisturbed.

PART 2 - PRODUCTS

2.1 Materials

.1 Bentonite seal is to be installed as per BC Groundwater Association regulations - backfill to be 20% admix by weight as per AWWA A100-06. Installation must be done by a registered pump installer with the association.

2. Gravel to be composed of inert, durable material, reasonably uniform in quality and free from soft or disintegrated particles. In absence of satisfactory performance records over a five year period for particular source of material, soundness to be tested according to ASTM test procedure C-88 or latest revised issue. Maximum weight average losses for course and fine aggregates to be 30% when magnesium sulphate is used after five cycles.

.3 All crushed gravel when tested according to ASTM C-136 and ASTM C-117, or latest revised issue, to have a generally uniform gradation and conform to following sieve must have one or more fractured faces. Determination of the Ministry of Transportation and Highways' Specification I-11, Fracture Count for Coarse Aggregate, Method "A", which determines fractured faces by count. The Plasticity Index for crushed gravel to not exceed 6.0.

.4 Native material to be any workable soil free of organic or foreign matter; any material obtained within limits of Contract may be deemed native material if it is approved by the Departmental Representative. Native material is not acceptable if it is impracticable to control its water content or compact to specified density.

.5 Granular Pipe Bedding and Surround Material

Crushed or graded gravels: to conform to following gradation:

Sieve Designation	Percent Passing Type 1*	Type*2
25.0mm	100	100
19.0mm	90 - 100	90 - 100
12.5mm	65 - 85	70 - 100
09.5mm	50 - 75	--- ---
4.75mm	25 - 50	40 - 70
2.36mm	10 - 35	25 - 52
1.18mm	6 - 26	15 - 38
0.600mm	3 - 17	6 - 27
0.300mm	--- ---	3 - 20
0.075mm	0 - 5	0 - 8

*Type 1: standard gradation

*Type 2: to be used only in dry trench conditions and with Departmental Representative's prior approval.

.6 Top Soil for seeded areas: mixture of articulates, micro organisms and organic matter which provides suitable medium for supporting intended plant growth.

.1 Soil texture: The Canadian System of Soil Classification, to consist of 20 to 70 % sand, minimum 7 % clay, and contain 2 to 10 % organic matter by weight.

.2 Contain no toxic elements or growth inhibiting materials.

.3 Finished surface free from:

.1 Debris and stones over 50 mm diameter.

.2 Course vegetative material, 10 mm diameter and 100 mm length, occupying more than 2% of soil volume.

.4 Consistencies: friable when moist.

PART 3 - EXECUTION

3.1 Site Preparation

.1 Remove obstructions, ice and snow, from surfaces to be excavated within limits indicated.

3.2 Clearing and Grubbing

.1 Remove trees, stumps, logs, brush, shrubs, bushes, vines, undergrowth, rotten wood, dead plant material, exposed boulders and debris within areas designated on drawings.

.2 Remove stumps and tree roots below footings, slabs, and paving, and to not less than 200 mm below finished grade elsewhere.

.3 Dispose of cleared and grubbed material off site daily to disposal areas acceptable to authority having jurisdiction.

3.3 Excavation

.1 Topsoil stripping

.1 Do not handle topsoil while in wet or frozen condition or in any manner in which soil structure is adversely affected.

.2 Strip topsoil over areas to be covered by new construction, over areas where grade changes are required, and so that excavated material may be stockpiled without covering topsoil.

.3 Dispose of topsoil as directed by the Departmental Representative.

.2 Excavate as required to carry out work, in all materials met. Do not disturb soil or rock below bearing surfaces. Notify the Departmental Representative when excavations are complete. If bearings are unsatisfactory, additional excavation will be authorized in writing and paid for as additional work. Excavation taken below depths shown without Departmental Representative's written authorization to be filled with concrete of same strength as for footings at Contractor's expense.

.3 Excavate trenches to provide uniform continuous bearing and support for 100 mm thickness of pipe bedding material on solid and undisturbed ground. Trench widths below point 300 mm above pipe not to exceed diameter of pipe plus 600 mm.

3.4 Backfilling

.1 Inspection: do not commence backfilling until fill material and spaces to be filled have been inspected and approved by the Departmental Representative.

.2 Remove snow, ice, construction debris, organic soil and standing water from spaces to be filled.

.3 Lateral support: maintain even levels of backfill around structures as work progresses, to equalize earth pressures.

.4 Compaction: place backfill to underside of required sub-base and base layers, and compact to following Modified Proctor densities in compliance with ASTM D1557.

.1 Adjacent the well to minimum 95%

.2 Roads, driveways, shoulders, and re-shaped ditches to minimum 95%.

.3 Use caution in pipe and riser zones to ensure no damage to pipes or pumps.

.5 Blown rock material, not capable of fine grading, is not acceptable, imported material must be placed on this type of material.

.6 Against foundations or pumps and risers (except as applicable to

trenches and under slabs and paving): excavated material or imported material with no stones larger than 200 mm diameter within 600 mm of structures.

3.5 Contaminated Materials

.1 If contaminated materials are detected during excavation operations, immediately notify the Departmental Representative. Any contaminated materials to be disposed of using methods approved by the Departmental Representative.

3.6 Grading

.1 Grade so that water will drain away from walls and paved areas to catch basins and other disposal areas approved by the Departmental Representative. Grade to be gradual between finished spot elevations shown on drawings.

3.7 Shortage and Surplus

.1 Supply all necessary fill to meet backfilling and grading requirements and with minimum and maximum rough grade variance.

.2 Dispose of surplus material off site.

END OF SECTION

PART 1 - GENERAL

1.1 Section Includes

.1 Materials and installation for water mains, valves, valve boxes, and valve chambers, including flushing, testing and disinfection requirements for all piping.

1.2 Related Sections

.1 Section 01 11 05 – General Instructions.

.2 Section 03 30 00 – Cast in place Concrete

.3 Section 11 02 26 – UV System

.4 Section 11 02 27 – Package Sodium Hypochlorite System

.5 Section 11 09 25 – Analytical Monitoring

.6 Section 22 10 10.01 – Submersible Well Pump

.7 Section 22 11 16.01 – Piping Systems

.8 Section 22 11 16.02 – Piping Joints

.9 Section 22 11 16.04 – Check Valves

.10 Section 22 11 16.05 – Isolating Valves

.11 Section 22 42 01.01 – Appurtenances

.12 Section 31 00 99 – Earthworks for Minor Works

1.3 References

.1 American National Standards Institute/American Water Works Association (ANSI/AWWA):

.1 ANSI/AWWA B300-99, Hypochlorites.

.2 ANSI/AWWA C500-02, Metal-Seated Gate Valves for Water Supply Service (Includes Addendum C500a-95).

.3 ANSI/AWWA C504-00, Rubber-Seated Butterfly Valves.

.4 ANSI/AWWA C600-99, Installation of Ductile Iron Water Mains, and Their Appurtenances.

.5 ANSI/AWWA C651-99, Disinfecting Water Mains.

.6 ANSI/AWWA C800-01, Underground Service Line Valves and Fittings (Also Included: Collected Standards for Service Line Materials).

.7 ANSI/AWWA C906-15, Polyethylene (PE) Pressure Pipe and Fittings, 4 Inch through 65 Inch (100 mm – 1,650 mm), for Waterworks.

.2 American Society for Testing and Materials International, (ASTM):

.1 ASTM A307-02, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile.

.2 ASTM B88M-99, Standard Specification for Seamless Copper Water Tube Metric.

.3 ASTM C117-95, Standard Test Method for Material Finer Than 75 MU m (No. 200) Sieve in Mineral Aggregates by Washing.

.4 ASTM C136-01, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.

.5 ASTM C478M-97, Standard Specification for Precast Reinforced Concrete Manhole Sections Metric.

.6 ASTM D698-00a, Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft (600 kN-m/m3)).

.7 ASTM D2310-01, Standard Classification for Machine-Made "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

.8 ASTM D2657-97, Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.

.9 ASTM D2992-01, Standard Practice for Obtaining Hydrostatic or Pressure Design Basis for "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe and Fitting.

.10 ASTM D2996-01, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting Resin) Pipe.

.11 ASTM F714-01, Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

.12 ASTM C618-01, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.

.3 Canadian General Standards Board (CGSB):

.1 CAN/CGSB-8.1-88, Sieves, Testing, Woven Wire, Inch Series.

.2 CAN/CGSB-8.2-M88, Sieves, Testing, Woven Wire, Metric.

.3 CAN/CGSB-1.88-92, Gloss Alkyd Enamel, Air Drying and Baking.

.4 CGSB 41-GP-25M-77, Pipe, Polyethylene, for the Transport of Liquids.

.4 Canadian Standards Association (CSA International):

.1 CAN/CSA-A257 Series-M92(R1998), Standards for Concrete Pipe

.2 CAN/CSA-A3000-98(April 2001), Cementitious Materials Compendium (Consists of A5-98, A8-98, A23.5-98, A362-98, A363-98, A456.1-98, A456.2-98, A456.3-98).

.1 CAN/CSA-A8-98, Masonry Cement.

.3 CSA B137 Series-02, Thermoplastic Pressure Piping Compendium. (Consists of B137.0, B137.1, B137.2, B137.3, B137.4, B137.4.1, B137.5, B137.6, B137.8, B137.9, B137.10, B137.11 and B137.12)

.1 CSA B137.1-02, Polyethylene Pipe, Tubing, and Fittings for Cold-Water Pressure Services.

.2 CSA B137.3-02, Rigid Polyvinyl Chloride (PVC) Pipe for Pressure Applications.

.4 CAN/CSA-G30.18-M92(R1998), Billet Steel Bars for Concrete Reinforcement

.5 CAN/CSA-G164-M92(R1998), Hot Dip Galvanizing of Irregularly Shaped Articles

.5 Department of Justice Canada (Jus):

.1 Canadian Environmental Protection Act, 1999 (CEPA).

.6 Transport Canada (TC):

.1 Transportation of Dangerous Goods Act, 1992 (TDGA).

.7 The Master Painters Institute (MPI):

.1 Architectural Painting Specification Manual - March 1998(R2002).

.8 Underwriters' Laboratories of Canada (ULC):

.1 CAN/ULC-S520-1991, Hydrants.

.2 CAN4-S543-1984, Internal-Lug, Quick Connect Couplings for Fire Hose.

.9 National Fire Protection Association (NFPA):

.1 NFPA-291-Recommended Practice for Fire Flow Testing and Marking of Hydrants.

1.4 Submittals

.1 Submit shop drawings in accordance with Section 01 33 00 - Submittal Procedures.

2 Inform the Departmental Representative of proposed source of bedding materials and provide access for sampling at least 4 weeks prior to commencing work.

.3 Submit manufacturer's test data and certification that pipe materials meet requirements of this section at least 4 weeks prior to beginning work. Include manufacturer's drawings, information and shop drawings where pertinent.

.4 Pipe certification to be on pipe.

1.5 Close-out Submittals

.1 Provide record drawings, including directions for operating valves and well pumps, list of equipment required to operate valves, details of pipe material, piping systems, maintenance and operating instructions in accordance with Section 01 78 00 – Closeout Submittals.

.1 Include top of pipe, horizontal location of fittings and type, valves, valve boxes, valve chambers and hydrants.

.2 Include location, in plan only, of all water system components on property.

1.6 Waste Management and Disposal

.1 Separate waste materials for reuse and recycling in accordance with Section 01 74 21 – Construction/Demolition Waste Management and Disposal.

.2 Remove from site and dispose of packaging materials at appropriate recycling facilities.

.3 Collect and separate for disposal paper, plastic, polystyrene, corrugated cardboard packaging material in appropriate on-site bins for recycling in accordance with Waste Management Plan.

.4 Separate for reuse and recycling and place in designated containers Steel, Metal and, Plastic waste in accordance with Waste Management Plan.

.5 Place materials defined as hazardous or toxic in designated containers.

.6 Handle and dispose of hazardous materials in accordance with the CEPA, TDGA, Regional and Municipal regulations.

.7 Ensure emptied containers are sealed and stored safely.

.8 Divert unused metal and wiring materials from landfill to metal recycling facility as approved by the Departmental Representative.

.9 Divert unused concrete materials from landfill to local facilities as approved by the Departmental Representative.

.10 Dispose of unused asbestos cement pipe in accordance with regulations governing disposal of hazardous materials.

.11 Divert unused aggregate materials from landfill to appropriate facilities for reuse as approved by the Departmental Representative.

.12 Dispose of unused disinfection material at official hazardous material collections site approved by the Departmental Representative.

.13 Do not dispose of unused disinfection material into sewer system, into streams, lakes, onto ground or in other location where they will pose health or environmental hazard.

.14 Fold up metal banding, flatten and place in designated area for recycling.

1.7 Scheduling of Work

.1 Schedule Work without interrupting water supply to the Rogers Pass Maintenance Compound. Treated water is to be available to the compound at all times.

.2 Construction, testing and commissioning is to be scheduled so that water supply to the compound is not impacted.

.1 Ensure treated water level in the clearwell is at maximum reserve prior to any service interruption of existing treatment system or supply of treated water supply to the clearwell.

.2 Submit schedule of expected interruptions to water supply to the clearwell to the Departmental Representative for approval and adhere to interruption schedule as approved by the Departmental Representative.

.3 Notify the Departmental Representative minimum of 24 h in advance of any interruption to treated water supply to the clearwell.

.3 Notify fire department of any planned or accidental interruption of water supply to hydrants.

.4 Advise local police department of anticipated interference with movement of traffic.

PART 2 - PRODUCTS

2.1 Pipe, Joints and Fittings

.1 Polyethylene pressure pipe:

.1 NPS 1/2 to NPS 6: to CSA B137.1 type PE 3406, series 160, ASTM F714, type PE 3408, series DR 11.

.2 90 mm to 1600 mm: to CGSB 41 GP 25M, type PE 1404, series 250.

.4 Polyethylene to polyethylene joints: to be thermal butt fusion joined, to ASTM D2657.

.5 Cast iron fittings with flanged ends: to ANSI/AWWA C110/A21.10 for pipe size above NPS 4, Cement mortar lined to ANSI/AWWA C104/A21.4.

.6 Polyethylene fittings: to CSA B137.1, for pipe sizes NPS 4 and less.

2.2 Piping Insulation

.1 The polyethylene pipe is to be insulated complete with 1.27mm (50 mils) minimum black polyethylene jacket with UV inhibitor. Insulation of associated joints, fittings and accessories shall be as per manufacturer's recommendations, depending on the size and type of pipe involved.

.2 Pipe to be clean of surface dust or dirt and treated, if necessary, to insure a positive bond of the foam to the entire pipe surface. The pipes may be treated by sand blasting or the application of a chemical foam-bonding compound.

.3 Insulation:

.1 Material: rigid polyurethane foam, factory applied.

.2 Thickness: 75 mm or as required.

.3 Density: (ASTM D 1622) 35 to 46 kg/m3.

.4 Closed cell content: (ASTM D 2856) 90%, minimum.

.5 Water absorption: (ASTM D 2842) 4.0% by volume.

.6 Thermal conductivity: (ASTM C518) 0,020 to 0,026 W/m °C.

.7 System compressive strength: (modified ASTM D 1621 with 50 mil jacket) approximately 414 to 552 kPa, varies with pipe diameter.

.8 Temperature limitations:

- in service, -45 to 85°C
- installation, -34°C

.4 Outer jacket (Casing system):

.1 The outer jacket (casing system) to consist of custom blended back polyethylene, Scapa Tape # 366, 1.27mm (50 mils) or 1.90 mm (75 mils) thick, UV inhibited factory applied. The jacket is to have a modified butyl rubber adhesive to ensure positive adhesion to the foam insulation and shall be applied hot in two counterwound and overlapping layers each 0.64 mm (25 mils) thick to ensure a shrink tightened waterproof bond throughout its entire length.

.2 Jacket material: polyethylene UV inhibited, specially formulated for superior cold environment properties, Scapa Tape #366.

.3 Sealant: Butyl rubber and resin.

.4 Jacket thickness: 1.27mm.

.5 Minimum elongation: (ASTM D 1000) 300%, 6 month test.

.6 Service temperature range:

- in service, -45 to 85˚C
- installation, -34˚C to 71˚C

.7 Tensile Strength: (ASTM D-1000) 3,83 kg/cm wide.

.5 Insulated Pipe Joints:

.1 Pre-formed urethane half shells with heat shrink sleeves to be used at butt fused joints.

.2 All exposed end of insulation to be boated with an approved waterproofing sealant, as recommended by manufacture, after field cutting or trimming has been carried out.

.6 Insulated Kits for Fittings:

.1 All fittings to be provided with insulation kits.

.2 Insulation kits for fittings to consist of rigid polyurethane foam with a fully bonded polymer protective coating on all exterior surfaces, including ends. Kits to be supplied complete with silicone caulking for seams, stainless steel attachment straps,

clips and heat shrink leased or joint tape to seal between pipe and kits.

2.3 Pipe Bedding and Surround

.1 As described in this Section and in accordance with Section 31 00 99 – Earthwork for Minor Works.

.2 Concrete mixes and materials required for bedding cradles, encasement, supports, thrust blocks: to Section 03 30 00 - Cast-in-Place Concrete.

2.4 Backfill Material

.1 As described in this Section, as shown on Contract Drawings and in accordance with Section 31 00 99 – Earthwork for Minor Works.

2.5 Pipe Disinfection

.1 Sodium hypochlorite to ANSI/AWWA B300 to disinfect water mains and piping within the treatment plant.

.2 Undertake disinfection of water mains in accordance with ANSI/AWWA C651 and Departmental standards.

PART 3 - EXECUTION

3.1 Preparation

.1 Clean pipes, fittings, valves, and appurtenances of accumulated debris and water before installation.

.1 Inspect materials for defects to approval of the Departmental Representative.

.2 Remove defective materials from site as directed by the Departmental Representative.

3.2 Trenching

.1 Do trenching work in accordance with Section 31 00 99 – Earthwork for Minor Works.

.2 Trench depth to provide cover over pipe as indicated.

.3 Trench alignment and depth require the Departmental Representative's approval prior to placing bedding material and pipe.

3.3 Concrete Bedding and Encasement

.1 Do concrete work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.1 Place concrete to details as indicated.

.2 Pipe may be positioned on concrete blocks to facilitate placing of concrete. When necessary, rigidly anchor or weight pipe to prevent flotation when concrete is placed.

.3 Do not backfill over concrete within 24 hours after placing.

3.4 Granular Bedding

.1 Place granular bedding material in uniform layers not exceeding 150 mm compacted thickness to depth as indicated.

.2 Do not place material in frozen condition.

.3 Shape bed true to grade to provide continuous uniform bearing surface for pipe.

.4 Shape transverse depressions in bedding as required to suit joints.

.5 Compact each layer full width of bed to at least 95% of corrected maximum dry density.

.6 Fill authorized or unauthorized excavation below design elevation of bottom of specified bedding in accordance with Section 31 00 99 – Earthwork for Minor Works.

3.5 Pipe Installation

.1 Lay pipes to manufacturer's standard instructions and specifications. Do not use blocks except as specified.

.2 Join pipes in accordance with manufacturer's recommendations.

.3 Handle pipe by methods recommended by pipe manufacturer. Do not use chains or cables passed through pipe bore so that weight of pipe bears on pipe ends.

.4 Lay pipes on prepared bed, true to line and grade:

.1 Ensure barrel of each pipe is in contact with shaped bed throughout its full length.

.2 Take up and replace defective pipe

.3 Correct pipe which is not in true alignment or grade or pipe which shows differential settlement after installation greater than 10 mm in 3 m.

.5 Face socket ends of pipe in direction of laying. For mains on grade of 2% or greater, face socket ends up-grade.

.6 Do not exceed permissible deflection at joints as recommended by pipe manufacturer.

.7 Keep jointing materials and installed pipe free of dirt and water and other foreign materials:

.1 Whenever work is stopped, install a removable watertight bulkhead at open end of last pipe laid to prevent entry of foreign materials.

.8 Position and join pipes with equipment and methods approved by the Departmental Representative.

.9 Cut pipes in approved manner as recommended by pipe manufacturer, without damaging pipe or its coating and to leave smooth end at right angles to axis of pipe.

.10 Align pipes before jointing.

.11 Install gaskets to manufacturer's recommendations. Support pipes with hand slings or crane as required to minimize lateral pressure on gasket and maintain concentricity until gasket is properly positioned.

.12 Avoid displacing gasket or contaminating with dirt or other foreign material.

.1 Remove disturbed or contaminated gaskets.

.2 Clean, lubricate and replace before jointing is attempted again.

.13 Complete each joint before laying next length of pipe.

.14 Minimize deflection after joint has been made.

.15 Apply sufficient pressure in making joints to ensure that joint is completed to manufacturer's recommendations.

.16 Ensure completed joints are restrained by compacting bedding material alongside and over installed pipes or as otherwise approved by the Departmental Representative.

.17 When stoppage of work occurs, block pipes in an approved manner to prevent creep during down time.

.18 Recheck plastic pipe joints assembled above ground after placing in trench to ensure that no movement of joint has taken place.

.19 Do not lay pipe on frozen bedding.

.20 Do hydrostatic and leakage test and have results approved by the Departmental Representative before surrounding and covering joints and fittings with granular material.

.21 Backfill remainder of trench.

3.6 Valve Installation

.1 Install valves to manufacturer's recommendations at locations as indicated.

.2 Support valves located in valve boxes or valve chambers by means of bedding same as adjacent pipe. Maximum length of pipe on each end of valve shall be 1 m. Valves not to be supported by pipe.

.3 Install underground post-type indicator valves as indicated.

3.7 Thrust Blocks and Restrained Joints

.1 For thrust blocks: do concrete Work in accordance with Section 03 30 00 - Cast-in-Place Concrete.

.2 Place concrete thrust blocks between valves, tees, plugs, caps, bends, changes in pipe diameter, reducers, hydrants and fittings and undisturbed ground as indicated or as directed by the Departmental Representative.

.3 Keep joints and couplings free of concrete.

.4 Do not backfill over concrete within 24 hours after placing.

.5 For restrained joints: only use restrained joints approved by the Departmental Representative.

3.8 Hydrostatic and Leakage Testing

.1 Do tests in accordance with ANSI/AWWA C600.

.2 Provide labour, equipment and materials required to perform hydrostatic and leakage tests hereinafter described.

.3 Notify the Departmental Representative at least 48 hours in advance of proposed tests.

.1 Perform tests in presence of the Departmental Representative.

.4 Where section of system is provided with concrete thrust blocks, conduct tests at least 5 days after placing concrete or 2 days if high early strength concrete is used.

.5 Test pipeline in sections not exceeding 365 m in length, unless otherwise authorized by the Departmental Representative.

.6 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes between joints with approved granular material placed to dimensions indicated.

.7 Leave hydrants, valves, joints and fittings exposed.

.8 When testing is done during freezing weather, protect hydrants, valves, joints and fittings from freezing.

.9 Strut and brace caps, bends, tees, and valves, to prevent movement when test pressure is applied.

.10 Open valves.

.11 Expel air from main by slowly filling main with potable water.

.1 Install corporation stops at high points in main where no air-vacuum release valves are installed.

.2 Remove stops after satisfactory completion of test and seal holes with plugs.

.12 Fill asbestos cement pipe and concrete pipe at least 24 hours before testing to allow water absorption by pipe material.

.13 Thoroughly examine exposed parts and correct for leakage as necessary

.14 Apply hydrostatic test pressure of 1380 kPa based on elevation of lowest point in main and corrected to elevation of test gauge, for period of 1 hour.

.15 Examine exposed pipe, joints, fittings and appurtenances while system is under pressure.

.16 Remove joints, fittings and appurtenances found defective and replace with new sound material and make watertight.

.17 Repeat hydrostatic test until defects have been corrected.

.18 Apply leakage test pressure of 690 kPa after complete backfilling of trench, based on elevation of lowest point in main and corrected to elevation of gauge, for period of 2 hours.

.19 Define leakage as amount of water supplied from water storage tank in order to maintain test pressure for 2 hours.

.20 Do not exceed allowable leakage of 1.25 L/day/km/mm of pipe, including lateral connections.

.21 Locate and repair defects if leakage is greater than amount specified.

.22 Repeat test until leakage is within specified allowance for full length of water main.

3.9 Pipe Surround

.1 Upon completion of pipe laying and after the Departmental Representative has inspected Work in place, surround and cover pipes as indicated.

.2 Hand place surround material in uniform layers not exceeding 150 mm compacted thickness as indicated.

.1 Do not dump material within 2 m of pipe.

.3 Place layers uniformly and simultaneously on each side of pipe.

.4 Do not place material in frozen condition.

.5 Compact each layer from pipe invert to mid height of pipe to at least 95% of corrected maximum dry density.

.6 Compact each layer from mid height of pipe to underside of backfill to at least 90% of corrected maximum dry density.

3.10 Backfill

.1 Place backfill material, above pipe surround, in uniform layers not exceeding 200 mm compacted thickness up to grades as indicated.

.2 Do not place backfill in frozen condition.

.3 Under paving and walks, compact backfill to at least 95% corrected maximum dry density.

.1 In other areas, compact to at least 90% corrected maximum dry density.

3.11 Flushing and Disinfecting

.1 Flushing and disinfecting operations: witnessed by the Departmental Representative carried out by specialist contractor.

.1 Notify the Departmental Representative at least 4 days in advance of proposed date when disinfecting operations will begin.

.2 Flush water mains through available outlets with a sufficient flow of potable water to produce velocity of 1.5 m/s, within pipe for minimum 10 minutes, or until foreign materials have been removed and flushed water is clear.

.3 Flushing flows as follows:

Pipe Size (NPS)	Flow (L/s) minimum
6 and below	38
8	75
10	115
12	150

.4 Provide connections and pumps for flushing as required.

.5 Open and close valves, hydrants and service connections to ensure thorough flushing.

.6 When flushing has been completed to the Departmental Representative approval, introduce strong solution of chlorine as approved by the Departmental Representative into water main and ensure that it is distributed throughout entire system.

.7 Disinfect water mains-Specialist contractor to perform disinfection.

.8 Rate of chlorine application to be proportional to rate of water entering pipe.

.9 Chlorine application to be close to point of filling water main and to occur at same time.

.10 Operate valves, hydrants and appurtenances while main contains chlorine solution.

.11 Flush line to remove chlorine solution after 24 hours.

.12 Measure chlorine residuals at extreme end of pipe-line being tested.

.13 Perform bacteriological tests on water main, after chlorine solution has been flushed out.

.1 Take samples daily for minimum of two days.

.2 Should contamination remain or recur during this period, repeat disinfecting procedure.

.3 Specialist contractor to submit certified copy of test results.

.14 Take water samples at hydrants and service connections, in suitable sequence, to test for chlorine residual.

.15 After adequate chlorine residual, not less than 50 ppm, has been obtained leave system charged with chlorine solution for 24 hours.

.1 After 24 hours, take further samples to ensure that there is still not less than 10 ppm of chlorine residual remaining throughout system.

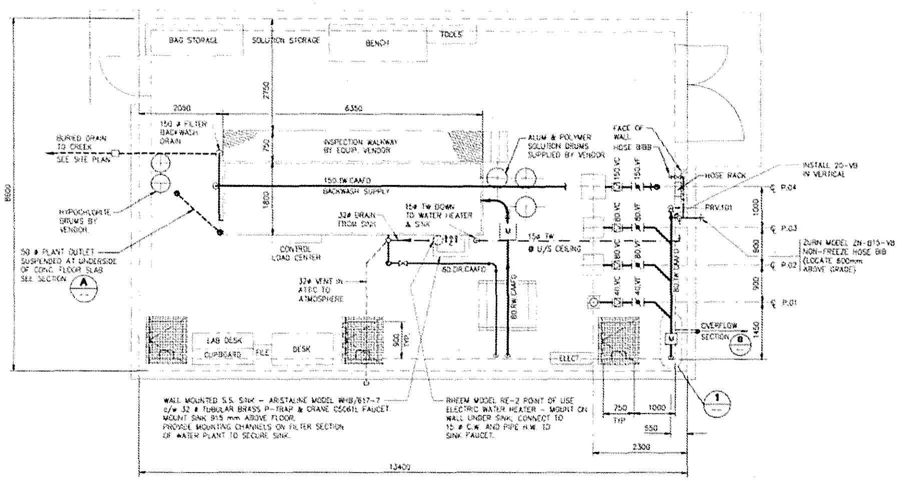
3.12 Surface Restoration

.1 After installing and backfilling over water mains, restore surface to original condition as directed by the Departmental Representative.

.2 After installing water mains into the Water Treatment Facility, restore exterior wall to original condition as directed by the Departmental Representative.

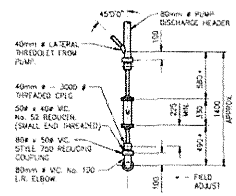
END OF SECTION

Appendix A **Rogers Pass Water Treatment Plant - Process System Layout Details (Drawing G95R1P2, Dated 95-03-03)**

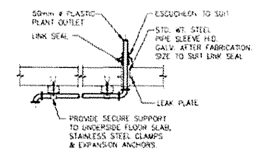


MAIN FLOOR PLAN
SCALE 1 : 50

NOTE: SMALL DIAMETER TUBING, CHEMICAL FEED SYSTEMS, SUPPLIED AS VENDOR PACKAGE NOT SHOWN. COMPLETE SYSTEMS TO BE PROVIDED BY CONTRACTOR AS SPECIFIED.



1 METER PIPING DETAIL
SCALE 1 : 25



A SECTION
SCALE 1 : 25

PLANT OPERATION:

Water plant will normally run between clearwell elevations 97.750 and 99.00. At rate of 16.35 m^3/hr (60 USgpm) and no usage, the treatment plant will run for 2.75 hours.

Pump will have an "enable start" at elevation 96.300 with pump stop at elevation 95.750 (i.e. 150 depth left in clearwell) Pump rate 16.35 m^3/hr (60 USgpm), the pump(s) can run for 19.8 (calc'd storage)/16.35 = 1.2 hours with no plant influent.

A low level alarm will trigger at elevation 96.000, 250 mm above pump stop or 0.55 hours before low level pump stop (33 minutes).

At high level, an alarm will be triggered by a level elevation 99.075 (75 mm or 3" above normal maximum W.L.).

This equates to 10 minutes run time at normal plant throughput and no usage.

At a further increase in level of 50 mm to elevation 99.125 the invert of the overflow pipe will be reached and the clearwell will begin to spill water.

Contact chamber overflow weir is set at elevation 99.275 which is approximately 150 mm above clearwell overflow pipe invert. This ensure no chance of "backflow" from clearwell into contact chamber area.

CONTROL PHILOSOPHY:

A. Water Treatment Package Plant will run between levels indicated.

B. To maintain distribution pressure, following operation will be provided:

1) Jockey pump P-01 will operate during low demand conditions, running continuously to maintain system pressure. Relief valve PRV-101 will relieve excess pressure to clearwell, set at 1,515 kPa (75 psi). pumps selection based on operation pressure of 450 kPa (65 psi).

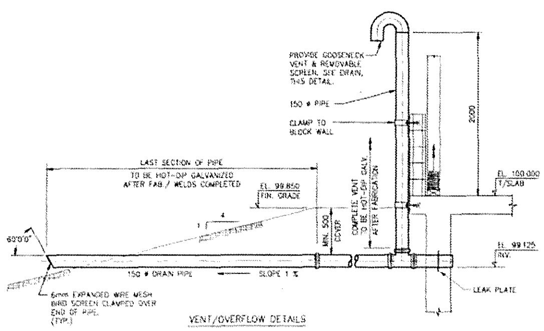
2) When header pressure drops to 380 kPa (55 psi) indicating jockey pump can't keep up with system demand, pre-selected duty pump (P-02 or P-03) will start. After delay (preset) of up to 120 seconds (set at 10 seconds initially) jockey pump will drop out.

3) When flow meter reads flow has dropped back to 0.8 l/sec., a timer will commence run (present adjustable timers) and after 2 minutes, below this setpoint, will cause the jockey pump to start. After a brief time delay, set for 5 seconds, the duty pump will stop.

System will repeat.

C. The backwash pump P-04 is utilized solely to backwash the filters. Therefore, its control is tied to water plant package control, with low – level protection common to the other pumps.

D. Start permissive at noted elevations will allow any pump to start (manual override can allow operator to run pump dry, will need operator training and cautions posted).



VENT/OVERFLOW DETAILS

B SECTION
SCALE 1 : 25

95-05-04

No.	Date	Description	Drawn by / Dessiné par	Approved / Approuvé
0	95-03-03	FOR TENDER & CONSTRUCTION	D.M.	G.F.

Revision / Révision

Detail number / Numéro de détail — Sheet number / Numéro de la feuille
Linear dimensions in millimetres / Dimensions linéaires en millimètres

Consultant's Name / Nom de l'expert-conseil: UMA Engineering Ltd. Engineers & Planners 3877-135-00
Eng. Stamp / Sceau de l'ingénieur

Public Works and Government Services Canada / Travaux publics et Services gouvernementaux Canada
Architecture and Engineering / Architecture et génie
Canada

Client/client: Canadian Heritage / Patrimoine Canadien — Parks Canada / Parcs Canada — Western Region / Région de l'Ouest

Project title/Titre du projet:
ROGERS PASS
WATER TREATMENT PLANT

GLACIER NATIONAL PARK

Drawing title/Titre du dessin:
PROCESS SYSTEM
LAYOUT DETAILS

Surveyed by/Arpenté par	Drawn by/Dessiné par	Date
N/A	D. MZIK	95-03-03
Designed by/Conçu par	**Reviewed by/Revisé par**	**Scale/Échelle**
G. PFEIFER	R. SILLITTO	AS SHOWN

Client Acceptance/Acceptation du client — Approved by/Approuvé par

Project No./No du projet	Asset No./No du bien	Sheet No./No de la feuille
#77146	974003604	P2

Drawing Reference No./No de référence du dessin: G95R1

File No. SG5603A1